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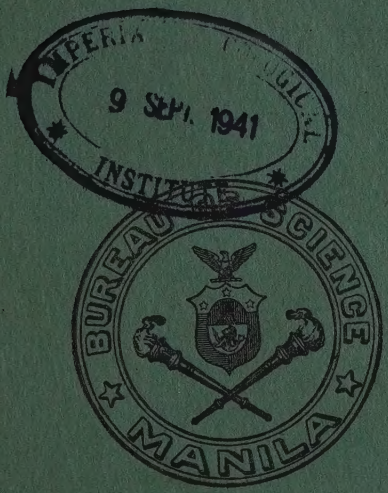

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To replace Plate 1 in the article cited.

PLATE 1.

THE PHILIPPINE
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MALACODERMATA VON DEN PHILIPPINEN AUS DER SAMMLUNG DES ZOOLOGISCHEN MUSEUMS IN AMSTERDAM

8. BEITRAG ZUR KENNTNIS DER INDO-MALAYISCHEN MALACODERMATA

Von W. WITTMER
Zürich, Schweitz

ZWEI TEXTFIGUREN

Die in der vorliegenden Arbeit behandelten Arten entstammen einer Bestimmungssendung von ungefähr 2800 Stück, aus der Sammlung des Zoologischen Museums, Amsterdam. Die Tiere wurden von Herrn Boettcher in den Jahren 1914–1918 auf den Philippinen gesammelt, sind dann durch Kauf in den Privatbesitz des Cleridenspezialisten Herrn J. B. Corporaal übergegangen, der sie später, zusammen mit seinen übrigen entomologischen Sammlungen, dem genannten Museum geschenkt hat.

Es handelt sich um die reichste Ausbeute die je aus dieser Gruppe der Malacodermata von den Philippinen gebracht wurde. Die Anzahl der bekannten Formen, den zentralen Inseln entstammend, also mit Ausschluss von Palawan, erhöht sich durch die nachfolgend beschriebenen um 28, und bringt die Gesamtzahl der Arten aus den Familien der Drilidæ, Cantharidæ, Malachiidæ, Dasytidæ und Prionoceridæ auf 118. In der nachfolgenden Artenaufzählung sind neben den aus dem Zoologischen Museum in Amsterdam stammenden Formen auch alle übrigen bisher von den Philippinen beschriebenen Arten aufgezählt. Die von Boettcher aufgesammelten sind erkenntlich an den genauen Fundorten

und Daten, die hinter jedem Zitat aufgeführt sind, während bei den übrigen nur die Literaturangabe vermerkt ist. Die Holotypen und Cotypen aller Arten befinden sich in der Sammlung des Zoologischen Museums in Amsterdam; für die reichliche Ueberlassung von Dubletten für meine eigene Sammlung sage ich Herrn J. B. Corporaal meinen besten Dank.

Von der Aufzählung der Lampyridæ, die ebenfalls ziemlich reich vertreten sind, habe ich Abstand genommen, weil die bereits veröffentlichten Listen [1] ein hinreichendes Bild über die auf den Philippinen vorkommenden Formen, die meistens sehr weit, fast über alle Inseln, verbreitet sind, vermitteln. Die Sendung enthielt nur eine neue Art der Gattung *Colophotia* Motsch., deren Beschreibung nächstens anderweitig veröffentlicht wird.

Als bemerkenswertester Fund ist das Auffinden eines ersten Vertreters aus der Familie Dasytidæ und zwar aus der Gattung *Haplocnemus* Kies. zu erwähnen. Die Gattung findet ihre Hauptverbreitung im Mittelmeer; der östlichste und zugleich der südlichste Vertreter war aus Indien beschrieben.

DRILIDÆ

PLATERODRILUS CURTUS Pic.

Platerodrilus curtus Pic, L'Echange 47 (1931) 97, *hors-texte.*

MINDANAO, Surigao, Mai und November, 1915. PANAON, November, 1915.

Subgenus PLATERODRIPLESIUS novum

Von der Gattung *Platerodrilus* Pic *s. str.* einzig durch die Bildung der Fühler verschieden, die, anstatt etwas flachgedrückt und leicht gezahnt oder fadenförmig, vom dritten Gliede an nach innen lang und fadenförmig ausgezogen sind (ähnlich wie bei *Phengodes* oder *Phrixothrix,* mit dem Unterschiede, dass aus jeder Spitze des Gliedes nur eine, anstatt wie dort zwei Verlängerungen entspringen und die Fühler anstatt ziemlich lang, schräg abstehend, äusserst kurz, grob und dicht, anliegend behaart sind). Die Verlängerungen sind verhältnismässig robust und erreichen bei den mittleren Gliedern etwa die sechsfache Länge des Stammgliedes, beim 3. Gliede nur die vierfache Länge.

PLATERODRILUS (PLATERODRILOPLESIUS) BICOLOR sp. nov.

Schwarz, Mandibeln und Clypeus etwas aufgehellt, braun, Halsschild und Unterseite des Kopfes rotbraun.

[1] Olivier, Ann. Soc. Ent. France (1886) 132–133, 182–187; M. Pic, Philip. Journ. Sci. 25 (1924) 712, 713.

Kopf mit den leicht hervortretenden Augen so breit wie der Halsschild an den Vorderecken, fein, dicht punktiert und behaart. Fühler fast von Körperlänge, 2. Glied äusserst kurz, vom 1. Glied fast verdeckt; 3. Glied kaum halb so lang wie das 4.; letzteres etwas schmäler als das 3. 5. Glied und folgende Glieder bis zum 10. unter sich ungefähr von gleicher Länge, in der Dicke allmählich abnehmend. Spitze eines jeden Gliedes vom 3. an in einen langen, mehr oder weniger gekrümmten Fortsatz ausgezogen. Halsschild breiter als lang, mit nach vorne konvergierenden Seiten, Basalecken spitzwinklig, Vorderecken stumpf, Halsschild in der Mitte leicht gewölbt, Seiten flach abgesetzt, chagrinartig punktiert, dicht gelb behaart. Flügeldecken runzlig skulptiert mit Spuren von acht Längsrippen, von denen drei deutlicher ausgeprägt sind als die übrigen, gegen die Spitze erlöschen die Rippen ganz.

Länge, 8.5 Millimeter.

Fundort.—MINDORO, Calapan, 8. und 9. Februar, 1916.

BICLADODRILUS BAKERI Pic.

Bicladodrilus bakeri PIC, L'Echange 37 (1921) 15.

MINDANAO.

DODECATOMA TESTACEICEPS Pic.

Dodecatoma testaceiceps PIC, Philip. Journ. Sci. 25 (1924) 713.

OTOTRETADRILUS PHILIPPINUS sp. nov.

Männchen. Orangegelb, Fühler vom 2. Gliede an, Augen nebst deren Rand, Palpen, Spitze der Flügeldecken, Seitenrand des Abdomens, Spitze der Tibien und die Tarsen schwarzbraun bis schwarz. Ein Exemplar mit Fundort Bucas Grande, Socorro, 19. Oktober, 1916, hat einfarbig dunkle Fühler, stark angedunkelten Kopf, eine dunkle Mittellinie auf dem Halsschilde, schwarzes Schildchen, die Flügeldecken sind ebenfalls einfarbig dunkel bis auf die Schulterbeulen, die gelb gefärbt sind; ab. *maculata* nov.

Kopf deutlich punktiert, Fühler vom 3. Gliede an gesägt, mittlere Glieder breiter als lang. Halsschild mit den leicht gebogenen Seiten schmäler als die Flügeldecken an den Schultern. Basalecken fast rechtwinklig, Vorderecken stumpf, Scheibe mit deutlicher Mittellinie, Punktierung tief, zerstreut, Abstand der einzelnen Punkte grösser als deren Durchmesser. Flügeldecken verkürzt, nicht ganz zwei-drittel der Länge des Abdomens bedeckend, Enden spitz zulaufend, Punktierung der Spitzen grob und tief, unregelmässig, höchstens in der Mitte an der Naht und an den Seiten mit vier oder fünf aufeinanderfolgenden

Punkten besetzt, gegen die Basis wird die Punktierung weniger deutlich, runzlig verworren.

Länge, 7 bis 7.5 Millimeter.

Fundort.—LUZON, Nueva Vizcaya, Imugan, 4000 Fuss Höhe, 8. Juli, 1917: Laguna, Mount Banahao, 2000 Fuss Höhe, 16. April, 1914 (Holotype).

In der Färbung gleicht die Stammform *O. flavoscutellatus* ab. *innotaticollis* Wittm. von Java. Die Form und Punktierung der Flügeldecken gestatten jedoch eine leichte Unterscheidung der beiden nahe verwandten Arten. Bei der neuen Art laufen die Seiten der Decken gegen die Spitze in gerader Linie zu und die ganze Spitze ist mit einer grösseren Anzahl unregelmässiger, tiefer Punkte besetzt. Bei *O. flavoscutellatus* Wittm. laufen die Seiten gegen die Spitze in leichtem Bogen zusammen, die Decken verschmälern sich weniger schnell und die Spitzen sind runzlig skulptiert, der ganze Spitzenrand mit einer Reihe regelmässiger, tiefer Punkte versehen.

Subgenus PALPODRILONIUS novum

Unterscheidet sich von der Gattung *Drilonius* Kies. (*Curtodrilus* Pic) *s. str.* durch das stark verbreiterte und verlängerte letzte Glied der Kiefer- und Lippentaster. Dieses Glied ist etwas länger als der Abstand der Augen, ungefähr drei mal so lang wie breit, nach innen von der Basis bis zur Spitze gleichmässig erweitert, flachgedrückt, Oberseite seicht eingedrückt, Spitze gerundet, stumpf.

DRILONIUS (PALPODRILONIUS) INSULARIES sp. nov.

Einfarbig dunkelbraun bis schwarz, nur die Beine etwas heller braun gefärbt.

Kopf mit den Augen schmäler als der Halsschild, glatt. Fühler kaum so lang wie der halbe Körper, 1. Glied dick und kurz, so lang wie breit; 2. Glied kürzer und schmäler als das 1.; 3. Glied ungefähr so lang wie die folgenden, aber nicht so breit; 4. Glied etwas gezahnt, vom 5. Gliede an deutlich gezahnt. Halsschild doppelt so breit wie lang, in der Mitte am längsten, gegen die Seiten zu verschmälert, glatt, fein behaart. Flügeldecken langgestreckt, mit fünf Längsrippen (inklusiv Nahtrippe), dazwischen gitterartig in regelmässigen Reihen punktiert, gegen die Spitzen erlischt die Punktierung etwas.

Länge, 3.8 bis 4 Millimeter.

Fundort.—LUZON, Laguna, Los Baños, 12. Dezember, 1916.

Ein Exemplar von Nord Mindanao, Mumungan, 23. Februar, 1915, ist stark aufgehellt, vordere Hälfte des Kopfes gelb, Hals-

schild ebenfalls gelb bis auf eine dunkle Makel in der Mitte am Vorderrand und je einer kleineren an den Seitenrändern, Flügeldecken schwarz, basales Drittel gelb; ab. *basitincta* nov. Vielleicht eine selbständige Art, eine Frage die erst aufgeklärt werden kann aufgrund reicheren Materials.

CANTHARIDÆ

TYLOCERUS ATRICORNIS Guérin.

Tylocerus atricornis GUÉRIN, Voy. Favorite (1838) 37.

SAMAR, Catbalogan, April, 1915. BASILAN, Oktober, 1915. PANAON, November, 1915. MINDANAO, Surigao, November, 1915; Kolambugan, Januar, 1915; Port Banga, Januar, 1915. MINDORO, Calapan, Februar, 1916; San Teodoro (Suban), Januar, 1916. BOHOL, Juli, 1916. CATANDUANES, Virac, März, 1916. LEYTE, Burauen, Mai, 1915.

TYLOCERUS MINDANAONUS Pic.

Tylocerus mindanaonus PIC, Philip. Journ. Sci. 25 (1924) 718.

NORD-MINDANAO, Surigao, Mai, 1915.

TYLOCERUS SERICEUS Pic.

Tylocerus serieceus PIC, Philip. Journ. Sci. 25 (1924) 722.

LUZON, Imugan, Mai und Juni, 1916; Mount Polis, 2400 Fuss Höhe, Februar, 1917; Trinidad, 4000 Fuss Höhe, Mai, 1914; Lubuagan, 3500 Fuss Höhe, Februar, 1917; Benguet, Haight's Place, 8000 Fuss Höhe, März, 1917.

TYLOCERUS SERICEUS var. BASITINCTA var. nov.

Gekennzeichnet durch die Färbung des Halsschildes, der, anstatt wie bei der Stammform einfarbig dunkel zu sein, gelbliche Basalecken aufweist; manchmal ist der ganze Basalrand und die Seiten, oft bis nach der Mitte, gegen den Vorderrand schmal gelb gesäumt. Bei zwei Exemplaren sind auch die beiden ersten Fühlerglieder etwas aufgehellt.

Fundort.—LUZON, Nueva Viscaya, Imugan, 4000 Fuss Höhe, Mai und Juni, 1916; Kalinga, Lubuagan, 3500 Fuss Höhe, Februar, 1917.

TYLOCERUS VITTIGERUS Pic.

Tylocerus vittigerus PIC, Philip. Journ. Sci. 25 (1924) 721.

NORD-LUZON, Benguet, Haight's Place, 8000 Fuss Höhe, März, 1917.

TYLOCERUS INVITTATUS Pic.

Tylocerus invittatus PIC, Philip. Journ. Sci. 25 (1924) 720.

TYLOCERUS BAKERI Pic.

Tylocerus bakeri Pic, Philip. Journ. Sci. 25 (1924) 719.

LUZON, Mount Banahao, 2000 Fuss Höhe, April und Juni, 1914.

TYLOCERUS DISCOVITTATUS Pic.

Tylocerus discovittatus Pic, Philip. Journ. Sci. 25 (1924) 720.

NORD-MINDANAO, Dansalan, Februar, 1915.

TYLOCERUS GRISEUS sp. nov.

Männchen.—Schwarz, Halsschild rotorange, Vorderrand meist etwas angedunkelt, Flügeldecken greis behaart, vor der Spitze (ein Viertel ihrer Länge) dunkelbraun bis schwarz behaart.

Fühler die Spitzen der Flügeldecken fast erreichend, 1. Glied zur Spitze ziemlich stark verdickt, ungefähr so lang wie das 3.; 4. bis 10. Glied unter sich von fast gleicher Länge, vom 5. Glied an schwach verbreitert, leicht flachgedrückt; 11. Glied etwas länger als das 10., zur Spitze verschmälert. Halsschild breiter als lang, Seiten nach vorne schwach verengt, fast parallel, Ränder ringsum leicht erhaben, Scheibe matt, in der Mitte mit zwei undeutlichen Erhabenheiten deren Oberseite glatt ist und glänzt. Flügeldecken matt chagriniert, mit je ein bis zwei undeutlichen Längsrippen.

Weibchen.—Wie das Männchen gefärbt, Fühler etwas kürzer, Halsschild plumper, nach vorne stärker verengt, die greise Behaarung der vorderen drei Viertel der Decken mitunter dichter als beim Männchen.

Länge, 9.5 bis 10 Millimeter.

Fundort.—SÜD-LUZON, Mount Isarog, 4000 Fuss Höhe, April, 1915.

Von *T. bakeri* Pic, mit der die neue Art nahe verwandt ist, unterscheidet sie sich durch breitere Gestalt, die Färbung des Halsschildes, der einfarbig orangegelb oder dessen Vorder- und Basalrand nur schmal schwarz gesäumt ist, und den einfarbig schwarzbraunen Grund der Flügeldecken. Bei *T. bakeri* Pic ist die vordere Hälfte des Halsschildes meist in mehr oder weniger grossem Umfange mit einer schwarzen Makel und die Flügeldecken in ihrer Mitte mit je einem gelbweissen Längswisch versehen, der vor der dunkleren Spitzenfärbung beginnt, hier am breitesten ist, gegen die Basis sich verschmälert, manchmal sind auch die Seiten in der Mitte ganz schmal hell gesäumt.

TYLOCERUS CONVEXITHORAX Pic.

Tylocerus convexithorax Pic, Philip. Journ. Sci. 25 (1924) 719.

TYLOCERUS HICKERI Pic.

Tylocerus hickeri PIC, Ent. Anzeiger 15 (1935) 254.

MINDANAO.

TYLOCERUS LUTEOAPICALIS Pic.

Tylocerus luteoapicalis PIC, L'Echange 42 (1926) 26, *hors-texte*.

LUZON.

TYLOCERUS (DISCODON?) PICI sp. nov.

Männchen.—Schwarz, Mundteile, 10. und 11. Glied, oder nur das Endglied der Fühler, Halsschild bis auf eine Makel am Vorderrand, Koxen meist aller Beine und Basis der Vorderschenkel gelb oder gelborange gefärbt. Schildchen gelb. Flügeldecken mit heller Naht, beginnend an der Basis und gelben Seiten, beginnend an der Basis unter den Schulterbeulen, Spitzen der Decken, ungefähr ein Viertel der Länge einnehmend, schwarz; vor der dunkeln Spitze fliessen die helle Naht und Seitensaum zu einer hellen Querbinde zusammen.

Kopf mit den Augen breiter als der Halsschild, Augen gross, stark hervortretend, Stirne zwischen den Augen leicht eingedrückt, glatt. Fühler fast von Körperlänge, 2. Glied kaum halb so lang wie das 3.; 3. Glied nicht ganz so lang wie das 4.; 4. bis 10. Glied unter sich ungefähr von gleicher Länge; 11. Glied kaum länger als das 10. Halsschild breiter als lang, Seiten nach vorne schwach verengt, Scheibe glatt, glänzend. Flügeldecken chagrinartig skulptiert, matt, an der Basis weniger stark chagriniert, fast glatt. Behaarung einfach, hell auf dem hellen und dunkel auf dem schwarzbraunen Grunde.

Länge, 7 bis 7.5 Millimeter.

Fundort.—NORD-MINDANAO, Mumungan, Februar und März, 1915.

Die Färbung charakterisiert die Art gut; verwandtschaftlich kann sie neben *T. vittigerus* Pic gestellt werden.

TYLOCERUS (DISCODON ?) MINOR sp. nov.

Männchen.—Schwarzbraun, Mundteile, 1. bis 3. Fühlerglied in mehr oder weniger grossem Umfange, manchmal auch das letzte Glied, Halsschild bis auf eine dunkle Makel am Vorderrand, Schildchen und Koxen der Vorderbeine gelborange gefärbt. Flügeldecken in der hinteren Hälfte etwas heller erscheinend, Behaarung an der Basis, besonders aber an den Spitzen dunkler als an der heller erscheinenden Stelle in der Mitte, die Grenze zwischen der dunkleren und der helleren Behaarung verschwommen.

Kopf mit den Augen etwas breiter als der Halsschild, Augen stark hervortretend. Fühler langgestreckt, 1. Glied wenig verdickt; 2. Glied halb so lang wie das 3.; 3. bis 10. Glied unter sich gleich lang, Halsschild breiter als lang, Seiten parallel, alle Ecken verrundet, Scheibe glatt, fein behaart. Flügeldecken matt, runzlig gewirkt.

Weibchen.—Plumper, Fühler kürzer, Halsschild nach vorne deutlich verengt.

Länge, 4.5 bis 5.5 Millimeter.

Fundort.—NORD-MINDANAO, Mumungan, February, 1915.

Mit *T. discovittatus* Pic nahe verwandt. Die neue Art unterscheidet sich durch etwas kleinere Gestalt, die Färbung der Fühler, deren Basis und Spitze aufgehellt ist, die Form des Halsschildes mit seinen fast parallelen Seiten und die Flügeldecken, die keinen metallischen Schimmer und keine hellen Längsbinden aufweisen. *T. discovittatus* Pic hat einfarbig dunkle Fühler, der Halsschild ist sehr kurz und breit, nach vorne fast halbkreisförmig verengt, die Flügeldecken schimmern grün metallisch und sind mit je einem mehr oder weniger deutlichen hellen Längsstreifen versehen.

PODABRINUS QUADRIIMPRESSUS sp. nov.

Rotbraun, Fühler vom 2. Gliede an, Tarsen und Flügeldecken ausgenommen die Schultern, dunkelbraun, Augen schwarz.

Kopf breit, mit den Augen gut so breit wie die Flügeldecken. Schläfen gegen den Halsschildvorderrand verengt (wie bei *Malthinus*). Stirne mit einem breiten Quereindruck an der Basis, der vom Halsschildvorderrand fast verdeckt ist, ein Längseindruck beginnt zwischen den Fühlerwurzeln und erstreckt sich gegen den Clypeus, die ganze Kopfoberfläche runzlig gewirkt, matt. Fühler fast so lang wie der Körper, alle Glieder langgestreckt, 2. Glied knötchenförmig, kaum so lang wie breit. Halsschild etwas länger als breit, Vorderrand gerundet, in der Mitte ziemlich stark vorgezogen, Seiten leicht geschweift, zur Basis kaum verengt. Jederseits in der vorderen Hälfte des Halsschildes, gegen die Vorderecken mit einem ziemlich breiten Eindruck, zwei weitere Eindrücke in der Mitte, wovon der eine, grössere und seichtere vor dem Schildchen liegt, der andere, auf der vorderen Hälfte kurz nach der Mitte, ist etwas kleiner aber tiefer. Die beiden Eindrücke sind durch die Halsschildmittellinie miteinander verbunden. Basis and Höcker undeutlich, jedoch regelmässiger als der Kopf punktiert, Grund der Seiteneindrücke bis zu den Vorderecken runzlig gewirkt. Flügeldecken

fast viermal so lang wie an den Schultern breit, runzlig gewirkt, mit deutlichen Querrunzeln, schräg abstehend behaart. Klauen einfach.

Länge, 6.5 bis 7 Millimeter.

NORD-MINDANAO, Mumungan, 25. Februar, 1915.

Neben *P. singularicollis* Pic zu stellen, mit der die neue Art nahe verwandt zu sein scheint.

DISCODON GRANULIPENNIS Boheman.

Discodon granulipennis BOHEMAN, Eugenies Reise (1858) 78.

LUZON, Mount Banahao, 2000 Fuss Höhe, April bis Juni, 1914. MINDORO, Calapan, 7, Februar, 1916.

Die Exemplare der nachfolgenden Fundorte unterscheiden sich von der Stammform durch die Färbung der Fühler, die einfarbig gelb sind, oder bei denen nur das 1. und 2., manchmal auch das 3. und 4. Glied schwarz ist; ab. *tincticornis* nov. Die Stammform hat einfarbig schwarze Fühler.

SAMAR, Catbalogan, April, 1915. SIARGAO, Dapa, September, 1916; Cabuntug, September, 1916. PANAON, November, 1915. NORD-MINDANAO, Surigao, Mai, 1915.

DISCODON VANIKORENSE Boisduval.

Discodon vanikorense BOISDUVAL, Voy. Astrolabe Ent. 2 (1835) 134.

NORD-MINDANAO, Dansalan, Februar, 1915; Mumungan, Februar und März, 1915; Surigao, Mai und August, 1915. BASILAN, Dezember, 1915.

DISCODON TANGKULANUM Pic.

Discodon tangkulanum PIC, Philip. Journ. Sci. 25 (1924) 715.

NORD-MINDANAO, Mumungan, Februar, 1915.

DISCODON ATROCYANEUM Pic.

Discodon atrocyaneum PIC, Philip. Journ. Sci. 25 (1924) 716.

LUZON, Mount Isarog, 4000 Fuss Höhe, April, 1916; Imugan, 4000 Fuss Höhe, Juni, 1917.

DISCODON ATROCYANEUM var. PALLIDICORNE Pic.

Discodon atrocyaneum var. *pallidicorne* PIC, Ent. Anzeiger 14 (1934) 54.

NORD-MINDANAO, Surigao, Mai, 1915.

DISCODON BAGUIONUM Pic.

Discodon baguionum PIC, Philip. Journ. Sci. 25 (1924) 714.

LUZON, Nueva Viscaya, Imugan, 4000 Fuss Höhe, Mai, 1916; Kalinga, Lubuagan, 3500 Fuss Höhe, Januar und Februar, 1917;

Balbalan, Januar, 1917; Benguet, Trinidad, 4000 Fuss Höhe, Mai, 1914; Mount Banahao, 2000 Fuss Höhe, April, 1914.

DISCODON SUBLINEATUM Pic.

Discodon sublineatum PIC, L'Echange 55 (1939) 170, *hors-texte*.

NORD-MINDANAO, Mumungan, Februar und März, 1915; Surigao, Mai, 1915.

Die Beschreibung Pic's bezieht sich auf das männliche Geschlecht. Die Weibchen unterscheiden sich durch grün oder blau gefärbte, metallisch schimmernde Flügeldecken, gelb ist nur ein schmaler Saum der sich von der Basis unter den Schultern bis kurz vor die Spitzen erstreckt. Halsschild einfarbig orangerot, oder mit einer mehr oder weniger grossen Makel auf der vorderen Hälfte. Fühler gelb, nur die beiden ersten Glieder und das letzte Glied in mehr oder weniger grosser Ausdehnung dunkel. Beine gelb, Knie, Tibien und Tarsen meist dunkel; ab. *bicoloricorne* nov. Auch das Männchen bildet in der Färbung eine von der Stammform abweichende Form, bei der die Flügeldecken wie bei den Weibchen gezeichnet, beziehungsweise gefärbt sind.

DISCODON PHILIPPINENSIS (Pic).

Cantharis philippinensis PIC, Mél. exotico-ent. 33 (1921) 29.

LUZON, Mount Banahao, Mai, 1915; Imugan, Mai, 1916; Mount Isarog, April, 1915; Lubuagan, Januar, 1917.

Die Beine dieser Art sind meist einfarbig dunkel, die Makel des Halsschildes schlecht begrenzt. Einzelne Exemplare weichen in der Färbung ab und bilden die ab. *flavotincta* nov. mit einfarbig gelben Flügeldecken, oder mit gelben Decken, bei denen die Naht äusserst schmal schwarz gefärbt ist. Die Form des Halsschildes und die der Fühler erinnert stark an die nahe verwandte Art *D. sublineatum* Pic.

DISCODON THOMASI Pic.

Discodon thomasi PIC, L'Echange 42 (1926) 27, *hors-texte*.

LUZON.

DISCODON SURIGAONUM Pic.

Discodon surigaonum PIC, Philip. Journ. Sci. 25 (1924) 716.

DISCODON CORPORAALI sp. nov.

Einfarbig schwarzbraun, nur die Mundteile und die Vorder- und Basalecken des Halsschildes (Männchen), oft der ganze Vorder- und Basalrand (Weibchen), gelblich gefärbt.

Kopf mit den ziemlich stark hervortretenden, grob fazettierten Augen kaum breiter als der Halsschild, fein punktiert mit einer seichten Längsdepression zwischen den Augen. Fühler länger als der halbe Körper, die Koxen der Hinterbeine um zwei bis drei Fühlergliederlängen überragend, schnurförmig, 1. Glied etwas verdickt, leicht gebogen, nur wenig länger als das 3.; 2. Glied nicht ganz halb so lang wie das 3.; 3. Glied eine Spur kürzer als das 4.; 5 bis 10. Glied unter sich ungefähr von gleicher Länge; 11. Glied nur wenig länger als das 10. Halsschild fast quadratisch, Seiten leicht ausgeschweift, jederseits kurz nach der Mitte in der vorderen Hälfte, in der Nähe des Randes mit einem punktförmigen Eindrucke. Basal- und Vorderecken abgerundet, leicht vorstehend, Basalecken etwas stärker vorstehend als die vorderen, Scheibe mit einer höckerförmigen Erhebung jederseits an der Basis neben der Mittellinie. Behaarung von Kopf und Halsschild kurz, gelblich. Flügeldecken ungefähr viertehalb mal so lang wie an der Basis breit, über die ganze Länge fein chagrinartig gerunzelt, ziemlich dicht und kurz gelb behaart, mit vereinzelten längeren abstehenden Haaren, die an der Spitze etwas zahlreicher als an der Basis vertreten sind. Eine Klaue an jeder Tarse gespalten (Männchen), alle Klauen einfach (Weibchen).

Länge, 6 bis 7 Millimeter.

Fundort.—LUZON, Nueva Viscaya, Imugan, 4000 Fuss Höhe, Juni, 1916.

In der Färbung ist diese Art *D. philippinensis* Pic sehr ähnlich. Sie unterscheidet sich von ihr durch etwas weniger grosse Augen, weniger breiten, fast quadratischen Halsschild, die Behaarung der Decken, die viel dichter mit gelblichen Haaren besetzt sind, und die dünneren, etwas längeren Fühler.

RHAGONYCHA BIPARTITA sp. nov.

Rotbraun, Fühler vom 2. Gliede an, Augen, die apikalen zwei Drittel der Decken und die Tarsen mehr oder weniger schwarz. Kopf mit den Augen etwas breiter als der Halsschild, Stirne leicht gewölbt, fast glatt, nur mit vereinzelten Haarpunkten. Fühler nur wenig länger als der halbe Körper, 3. Glied länger als das 2.; 3. bis 10. Glied unter sich gleich lang, jedes Glied zur Spitze leicht verdickt; 11. Glied eine Spur länger als das 10. Halsschild breiter als lang, glatt, mit zwei undeutlichen Höckern in der Mitte, Mittelinie nur angedeutet, Seiten des Halsschildes in der Mitte leicht ausgeschweift, nach vorne schwach

verengt. Flügeldecken nur wenig breiter als der Halsschild, Viertehalb mal so lang wie breit, körnig skulptiert.

Länge, 4 Millimeter.

Fundort.—NORD-MINDANAO, Mumungan, Juli, 1915.

RHAGONYCHA (HARMONYCHA) BASICRASSICORNIS sp. nov.

Einfarbig schwarz, nur die Mundteile und der Clypeus bis zur Fühlerbasis braun; oder stark aufgehellt und nur die Augen, die Fühler vom 3. Gliede an, die Flügeldecken bis auf das basale Fünftel, alle Tarsen und die Hinterschienen mehr oder weniger dunkel; ab. *banosaca* nov.

Kopft breiter als lang, Stirne leicht gewölbt, glatt, zerstreut behaart. Fühler von kaum mehr als halber Körperlänge, 2. Glied knapp halb so lang die das 3., nur wenig schmäler als das 1.; 3. bis 5. Glied verdickt, 3. Glied etwas länger und stärker verdickt als das 4. und 5.; 3. und 4. Glied auf der Oberseite mit einer deutlichen Längseinkerbung, die manchmal von den Haaren fast vollständig verdeckt ist. Halsschild fast quadratisch, an den Basalecken etwas breiter als vorne, Seiten auf der vorderen Hälfte leicht ausgeschweift. Flügeldecken körnig skulptiert, ohne Spuren von Längsrippen. Alle Klauen gespalten.

Länge, 5 bis 6 Millimeter.

Fundort.—LUZON, Imugan, 7. Mai, 1916; Los Baños, 3. April, 1914.

MIMOPOLEMIUS LUZONICUM (Pic).

Discodon luzonicum PIC, Philip. Journ. Sci. 25 (1924) 717.

LUZON, Mount Banahao, Juni, 1914.

Die flachgedrückten, ziemlich stark gezahnten Fühler weisen für diesen und den nahe verwandten *Discodon mindanaonum* Pic auf die Gattung *Mimopolemius* Pic, in die ich sie stellen möchte. Vom gleichen Fundorte liegen mir drei Exemplare vor, die von *M. luzonicum* (Pic) sich durch einfarbig gelbe Flügeldecken unterscheiden; ab. *testacea* nov. Die Beine sind gelb mit schwarzen Knien, Tibien und Tarsen, oder gelb und nur die Knie und Tarsen schwarz.

MIMOPOLEMIUS (DISCODON) MINDANAONUM Pic.

Discodon mindanaonum PIC, Philip. Journ. Sci. 25 (1924) 715.

NORD-MINDANAO, Mumungan, Juni, 1915.

POLEMIOSILIS PICEOLATERALIS Pic.

Polemiosilis piceolateralis PIC, Philip. Journ. Sci. 25 (1924) 722.

LUZON, Mount Bulusan, 30. September, 1917; Los Baños, 3. April, 1914.

POLEMIOSILIS FORTICORNIS Pic.

Polemiosilis forticornis Pic, Philip. Journ. Sci. 25 (1924) 723.

Nord-Mindanao, Siargao, Mai, August und November, 1916; Momungan, Februar, 1915.

POLEMIOSILIS BOETTCHERI Pic.

Polemiosilis boettcheri Pic, in litt.

Siargao, Dapa, September und November, 1916; Cabuntug, September, 1916. Leyte, Santa Cruz, Oktober, 1915.

POLEMIOSILIS PROXIMUS Pic.

Polemiosilis proximus Pic, Philip. Journ. Sci. 25 (1924) 723.

Mindanao, Mumungan, Februar und März, 1915; Port Banga, Januar, 1915. Siargao, Dapa, November, 1916.

POLEMIOSILIS LATIORITHORAX Pic.

Polemiosilis latiorithorax Pic, in litt.

Mindanao, Surigao.

POLEMIOSILIS ATROAPICALIS Pic.

Polemiosilis atroapicalis Pic, L'Echange 40 (1924) 2, *hors-texte.*

POLEMIOSILIS SUBTRIANGULARIS Pic var.

Polemiosilis subtriangularis Pic var., L'Echange 41 (1924) 14.

SILIS CORDICOLLIS Pic.

Silis cordicollis Pic, Philip. Journ. Sci. 25 (1924) 726.

Nord-Mindanao, Surigao, Mai, 1915; Mumungan, März, 1915.

SILIS PLICICOLLIS sp. nov.

Männchen.—Gelb, Fühler bis auf die Basis des 1. Gliedes, Augen, Tarsen, schwarzbraun; Schenkel und Unterseite ebenfalls leicht angedunkelt.

Kopf mit den stark hervortretenden Augen nicht breiter als der Halsschild, fast glatt, glänzend, fein behaart. Fühler die Spitzen der Flügeldecken fast erreichend, 1. Glied verhältnismässig kurz und dick, kürzer als das 3.; 2. Glied äusserst kurz, knötchenförmig, breiter als lang, 3. bis 10. Glied alle langgestreckt, jedes etwa vier bis fünf mal so lang wie an der Basis breit, rund, zur Spitze schwach verdickt, 3. Glied etwas länger als die nachfolgenden Glieder. Halsschild breiter als lang, Seiten geschweift, an der Basis etwas schmäler, mit scharfen Ecken, am Vorderrand etwas breiter, Ecken leicht abgeschrägt, an den Vorderecken etwas stärker behaart als auf der Scheibe, die etwas vorstehenden Seiten weisen jederseits einen schwach gebogenen, gegen den Basalrand sich leicht verbreiternden, kanalförmigen

Eindruck auf, Aussenrand in seiner vorderen Hälfte deutlich nach innen geschlagen, Innenrand im basalen Teil eingekerbt und gegen die Halsschildscheibe geöffnet. Halsschildscheibe mit deutlichem Längseindruck an der Basis, gegen den Vorderrand erlischt der Eindruck allmählich, Punktierung deutlich, aber weniger tief als auf den Flügeldecken. Flügeldecken langgestreckt, Spitzen leicht auf die Unterseite gebogen, stark, fast körnig punktiert, Nahtrand und Epipleuralrand leicht erhaben, fein gekerbt.

Länge, 7 bis 7.5 Millimeter.

Fundort.—LUZON, Nueva Viscaya, Imugan, 4000 Fuss Höhe, 30. Mai, 1916.

Von *S. minimus* Pic durch grössere Gestalt und dunklere Färbung der Fühler, Beine, und Unterseite verschieden, auch der Halsschild ist verschieden geformt, anstelle eines mit den Seiten fast parallel laufenden Kanals sind die Seiten bei *minimus* nur mit einem kerbartigen Einschnitt versehen.

SILIS PLICICOLLIS var. APICEFLAVA var. nov.

Ein männliches Exemplar von Luzon, Los Baños, 3. März, 1914, unterscheidet sich von der Stammform durch hellere Färbung, nur die Augen und die Fühler vom 3. bis zum 9. oder 10. Gliede sind schwarz. Die Gestalt etwas kleiner, die Fühler um weniges kürzer.

SILIS BAKERI Pic.

Silis bakeri PIC, Philip. Journ. Sci. 25 (1924) 726.

NORD-MINDANAO, Mumungan, Februar und Juli, 1915; Surigao, 2. November, 1915. LEYTE, Burauen, Mai, 1915.

SILIS BAKERI var. BREVEAPICALIS Pic.

Silis bakeri var. *breveapicalis* PIC, Philip. Journ. Sci. 25 (1924) 726.

LUZON, Mount Banahao, April, 1914; Los Baños, April und Dezember, 1914.

SILIS BUKIDNONA Pic.

Silis bukidnona PIC, Philip. Journ. Sci. 25 (1924) 727.

SILIS BUKIDNONA var. BANAHAONA Pic.

Silis bukidnona var. *banahaona* PIC, Philip. Journ. Sci. 25 (1924) 727.

LUZON, Mount Banahao, April, 1914.

SILIS DILATICOLLIS Pic.

Silis dilaticollis PIC, Philip. Journ. Sci. 25 (1924) 727.

LUZON, Mount Banahao, April, 1914; Los Baños, Dezember, 1916.

SILIS ANANCOIDES Pic.

Silis anancoides PIC, L'Echange 40 (1924) 2, *hors-texte.*

SAMAR.

SILIS LONGELATERALIS Pic.

Silis longelateralis PIC, Mél. exotico-ent. 43 (1925) 2.

LUZON.

SILIS OBCONICICOLLIS Pic.

Silis obconicicollis PIC, L'Echange 40 (1924) 2, *hors-texte.*

SAMAR.

SILIS PROLONGATA Pic.

Silis prolongata PIC, L'Echange 40 (1924) 3.

SAMAR.

SILIS SAMARENSIS Pic.

Silis samarensis PIC, L'Echange 40 (1924) 2.

SAMAR.

SILIS LONGESUTURALIS Pic.

Silis longesuturalis PIC, L'Echange 41 (1925) 15.

LUZON.

LÆMOGLYPTUS (DRILOSILIS) ROBUSTICORNIS Pic.

Læmoglyptus (*Drilosilis*) *robusticornis* PIC, Philip. Journ. Sci. 25 (1924) 728.

NORD-MINDANAO, Surigao, 18. Mai, 1915.

Das mir vorliegende Exemplar weicht von der Stammform durch einfarbigen, rötlichen Halsschild und vollständig schwarze Flügeldecken ab; ab. *unicolorata* nov. Die Stammform hat eine schwarze Makel am Vorderrande des Halsschildes und die Naht der Decken ist gelb gefärbt.

LÆMOGLYPTUS (DRILOSILIS) SUTURALIS Pic.

Læmoglyptus (*Drilosilis*) *suturalis* PIC, Philip. Journ. Sci. 25 (1924) 728.

NORD-MINDANAO, Surigao, Mai, August und September, 1915; Mumungan, 9. Juli, 1915. SÜD-MINDANAO, Port Banga, 12. Januar, 1915.

Alle fünf mir vorliegenden Exemplare sind Weibchen. Es ist auffällig das von dieser mit *robusticornis* zusammenlebenden Art, die sich von ihr nur durch die dunkeln Fühler unterscheidet, bisher nur Weibchen aufgefunden worden sind, dagegen von *robusticornis*, dessen Fühler gelb sind, nur Männchen. Es ist zu vermuten dass die beiden Formen ein und derselben Art ange-

hören, und also *suturalis* Pic lediglich die weibliche Form von *robusticornis* Pic darstellt.

LÆMOGLYPTUS (DRILOSILIS) LITURATUS Pic.

Læmoglyptus (*Drilosilis*) *lituratus* PIC, L'Echange 39 (1924) 24.

LÆMOGLYPTUS sp. (prope SUTURALIS Pic).

Zwei Weibchen von Süd-Luzon, Mount Isarog, 10. April, 1916, und Mount Bulusan, Januar und Oktober, 1917, sind in der Körperform *L. suturalis* Pic ähnlich, jedoch Fühler, Beine und Flügeldecken einfarbig schwarz. Mit *rubrithorax* Pic wohl noch näher als mit *suturalis* verwandt. Von der Beschreibung dieser wahrscheinlich neuen Art sehe ich ab. Es empfiehlt sich die Arten dieser Gattung nur dann zu beschreiben, wenn auch die Männchen vorliegen, weil die Artmerkmale beim weiblichen Geschlecht zu wenig stark ausgeprägt sind.

LÆMOGLYPTUS sp. (prope LITURATUS Pic).

Ein Weibchen von der Insel Dinagat, 13. Dezember, 1915, ähnlich wie *lituratus* gefärbt, jedoch ist die dunkle Färbung der Flügeldecken auf das hintere Drittel beschränkt und die Naht bis zu dem ebenfalls dunkeln Schildchen schmal schwarz gesäumt. Vielleicht eine Variation von *lituratus*.

ICHTHYURUS DOHRNI Fairmaire.

Ichthyurus dohrni FAIRMAIRE, Stett. Ent. Zeit. (1867) 114.

LUZON, Nueva Viscaya, Imugan, 4000 Fuss Höhe, Mai, 1916, und Juni, 1917.

ICHCTHYURUS SCRIPTICOLLIS Fairmaire.

Ichthyurus scripticollis FAIRMAIRE, Stett. Ent. Zeit. (1867) 115.

MINDANAO, Port Banga, Januar, 1915; Dezember, 1915; Kolambugan, Januar, 1915; Mumungan, März, 1915. BASILAN, Dezember, 1914.

Bei den Exemplaren der Insel Basilan erreicht die Quermakel auf den Flügeldecken die Naht nicht ganz. Die Färbung würde also mit der von *I. bakeri* Pic übereinstimmen, der Bau des Analtergites zeight jedoch eindeutig die Zusammengehörigkeit mit *scripticollis*, dieselbe breite, eher kurze Gabel, die auf der Unterseite eine wellenlinienförmige, scharfe Kante aufweist, an der Basis zahnartig vorspringt, gegen die Spitze erlischt die Kante allmählich und wird hier durch eine andere Leiste ersetzt, die kurz vor der Spitze, etwas weiter nach innen gerückt, beginnt und in abnehmender Höhe bis zur Spitze reicht; var. *basilana* nov. Die Beine sind etwas heller als bei der Stammform gefärbt.

ICHTHYURUS BAKERI Pic.

Ichthyurus bakeri PIC, Philip. Journ. Sci. 25 (1924) 729.

LUZON, Nueva Viscaya, Imugan, Mai, 1916; Mount Banahao, 2000 Fuss Höhe, April und Mai, 1914. NORD-MINDANAO, Dansalan, Februar, 1915.

ICHTHYURUS SEMPERI Fairmaire.

Ichthyurus semperi FAIRMAIRE, Stett. Ent. Zeit. (1867) 113.

LUZON.

ICHTHYURUS BIMACULATUS Pic.

Ichthyurus bimaculatus PIC, Philip. Journ. Sci. 25 (1924) 729.

ICHTHYURUS PILICORNIS Pic.

Ichthyurus pilicornis PIC, Philip. Journ. Sci. 25 (1924) 730.

ICHTHYURUS BILINEATUS Pic.

Ichthyurus bilineatus PIC, Philip. Journ. Sci. 25 (1924) 730.

MICROICHTHYURUS BAGUIONUS Pic.

Microichthyurus baguionus PIC, Philip. Journ. Sci. 25 (1924) 730.

LUZON, Bontoc, Mount Polis, 2400 Fuss Höhe, Februar, 1917; Kalinga, Balbalasang, 4000 bis 5000 Fuss Höhe, März, 1918; Balbalan, 4000 Fuss Höhe, Januar, 1917; Lubuagan, 3500 Fuss Höhe, Februar, 1917.

Pic beschrieb diese Art als Variation zu *bicoloripennis* Pic. Grosse Serien die mir, besonders von *baguionus*, vorliegen, zeigen, dass es sich um zwei voneinander verschiedene Arten handelt, die im männlichen Geschlecht wie folgt auseinandergehalten werden können:

M. baguionus Pic. Männchen.	*M. bicoloripennis Pic. Männchen.*
Halsschild braun, oder gelb mit oder ohne dunklerem, verschwommenem Mittelfleck.	Halsschild stets dunkelbraun.
Flügeldecken gelb oder schmutzighellbraun, die Naht meist etwas dunkler, Spitzenflecken von gleicher Färbung wie der Rest der Decken oder nur wenig heller.	Flügeldecken braun bis dunkelbraun, Spitzenflecken hellgelb.
Analtergit äusserst schmal und lang, Spitze wenig tief eingeschnitten, kaum ein Fünftel der Länge ausmachend.	Analtergit kürzer und im Verhältinis zur Länge breiter, Einschnitt tiefer, bis zu ein Drittel der Länge reichend.
Fühler ziemlich dicht mit kurzen Haaren bedeckt.	Fühler neben den kurzen Haaren an den Basalgliedern mit einzelnen feinen, abstehenden, etwas längeren Haaren besetzt.

MICROICHTHYURUS BICOLORIPENNIS Pic.

Microichthyurus bicoloripennis PIC, Philip. Journ. Sci. 25 (1924) 730.

LUZON, Kalinga, Balbalan, Januar und Februar, 1917; Lubuagan, Januar, 1917; Amburayan, Naiba, Januar, 1917; Nueva Viscaya, Imugan, Mai und Juni, 1916. NORD-MINDANAO, Surigao, Mai, 1915.

MICROICHTHYURUS sp.

Eine vollständig schwarze Art, bei der nur die beiden ersten Fühlerglieder und die Seiten des Abdomens hell gefärbt sind, liegt in acht Exemplaren, alle Weibchen, von der Insel Basilan, Dezember, 1914, vor.

MICROICHTHYURUS CYANICOLLIS sp. nov.

Braunschwarz, die zwei bis drei ersten Fühlerglieder und die Seiten der ersten Bauchsegmente gelbeichweiss. Halsschild und manchmal auch der Kopf mehr oder weniger violett metallschimmernd.

Kopf mit den Augen etwas breiter als der Halsschild, glatt, Fühler ziemlich langgestreckt, 1. Glied das längste, doppelt so lang wie das 2.; 2. Glied um ungefähr ein Drittel kürzer als das 3.; 3. Glied eine Spur länger als das 4.; 5. Glied so lang wie das 2.; 6. Glied ungefähr ein Fünftel kürzer als das 5.; 7. bis 11. Glied unter sich ungefähr gleich lang, noch etwas kürzer als das 6.; alle Glieder fein und ziemlich dicht behaart, ausserdem mit einzelnen etwas längeren, abstehenden Haaren besetzt, 1. Glied mit ein oder zwei feinen, sehr langen, borstenförmigen Haaren versehen. Halsschild fast breiter als lang, zur Basis, beginnend bei den Vorderecken, schwach und in gerader Linie verengt. Basalrand und Seitenrand fast bis zu den Vorderecken sichtbar, Scheibe glatt mit angedeuteter Punktierung (Haarpunkte) und zwei bis vier mehr oder weniger deutlichen höckerartigen Erhabenheiten. Flügeldecken stark verkürzt, jede kaum länger als zusammen breit, Spitzen napfartig eingedrückt, Scheibe mit angedeuteten Längseindrücken, deren Grund erloschene Punktierung zeigt. Letztes Abdominaltergit des Männchens ungefähr ein Viertel länger als breit, Spitze nur schwach ausgerandet (nicht tief ausgeschnitten oder gespalten), auf der Unterseite sind etwas nach der Mitte, auf der Spitzenhälfte zwei kurze Bügel sichtbar, deren Spitzen gegeneinander gerichtet sind.

Länge, 3.8 bis 5 Millimeter.

Fundort.—MINDANAO, Dansalan, 13. Februar, 1915. PANAON, 2. Dezember, 1915, ein Weibchen.

Eine *M. robustus* Pic nahestehende Art, die sich in der Hauptsache durch einfarbig schwarze Beine und den blauen, beziehungsweise violett schimmernden Halsschild, manchmal auch Kopf, unterscheidet.

MICROICHTHYURUS PILICORNIS sp. nov.

Männchen.—Dunkelbraun bis schwarz, 1. bis 4. Fühlerglied, Spitzen der Flügeldecken, Abdominalsegmente teilweise und Beine (die Schienen sind oft etwas angedunkelt) gelb. Ein Exemplar besitzt gelbraune Flügeldecken, ebenfalls der Halsschild ist etwas aufgehellt mit gelblichem Basal- und Vorderrand.

Kopf mit den Augen breiter als der Halsschild, so breit wie die Flügeldecken, fein und zerstreut punktiert, Stirne leicht gewölbt, Mittellinie nur angedeutet, Behaarung fein, kurz und greis, auf der vorderen Hälfte länger, aber weniger dicht als an der Basis. Fühler ungefähr von halber Körperlänge, 2. und 3. Glied verkürzt, unter sich gleich lang; 4. Glied fast ein Drittel länger als das 3.; 5. Glied nur wenig kürzer als das 4., deutlich länger als das 3.; 6. bis 10. Glied jedes eine Spur kürzer als das vorangehende Glied, 10. Glied so lang wie das 3.; 11. Glied schwach flachgedrückt, an der breitesten Stelle etwas breiter als das vorangehende. Alle Glieder ziemlich dicht, fein und kurz behaart, vom 3. bis 5. oder 6. Glied auf der Innenseite ausserdem noch mit längeren Haaren besetzt, deren Spitzen gegen die Fühlerbasis zu gekrümmt sind. Basalglied mit zwei und 2. Glied mit vier borstenförmigen, büschelförmig angeordneten Haaren besetzt, von denen die ersteren etwas kürzer, die letzteren länger, so lang wie das 2. Fühlerglied, sind. Halsschild fast länger als breit, Seiten gegen die Basis regelmässig und schwach verengt, Basis und ein Teil der Seiten, bis zu Mitte, deutlich gerandet, Punktierung äusserst fein. Flügeldecken verkürzt, ungefähr ein Drittel so lang wie die hautigen Flügel, klaffend, runzlig gewirkt, matt, nur die hellen, eingedrückten Spitzen sind amz Grunde fast glatt. Letztes Abdominaltergit langgestreckt, zweimal so lang wie breit, bis zu ein Drittel der Länge dreieckig eingeschnitten, auf der Unterseite, die bis zur Basis eingeschnitten ist, sind zwei lange, schmale Valven sichtbar.

Länge, 3.5 bis 4 Millimeter.

Fundort.—LUZON, Amburayan, Butac, 1000 Meter Höhe, 11. Januar, 1917.

Verwandt mit *M. bicoloripennis* Pic, von der sich die Art hauptsächlich durch die Bildung der Fühler unterscheidet, deren 2. und 3. Glied bei *pilicornis* sp. nov. von gleicher Länge ist, und

die Art der Behaarung (1. Glied mit zwei borstenähnlichen Haaren in der Nähe der Spitze, 2. Glied mit vier längeren, büschelförmig angeordneten, borstigen Haaren, 3. bis 5. Glied auf der Innenseite mit einer Anzahl abstehenden, ziemlich feinen und langen Haaren besetzt, deren Spitzen gegen den Kopf zu gekrümmt sind), das 2. Fühlerglied von *bicoloripennis* Pic ist kürzer, nur halb so lang wie das 3., auch fehlen die Borsten auf dem 1. und 2. Gliede und die feinen längeren Haare auf der Innenseite des 3. bis 5. Gliedes.

MICROICHTHYURUS BRUNNEUS sp. nov.

Männchen.—Schwarzbraun, Beine und die zwei bis drei ersten Fühlerglieder gelblich, manchmal sind auch Kopf und Flügeldecken etwas aufgehellt (braun bis gelbbraun).

Kopf mit den Augen kaum breiter als der Halsschild, etwas schmäler als die Flügeldecken, Längsfurche kaum angedeutet, Punktierung ziemlich dicht und grob. Fühler nicht ganz halb so lang wie der Körper, 2. Glied fast um ein Drittel kürzer als das 3.; 3. und 4. Glied von gleicher Länge; 5. bis 10. Glied in der Länge leicht abnehmend; 11. Glied etwas länger als das 10., schwach flachgedrückt. Behaarung doppelt, kurz greis und am Innenrande lang abstehend, die langen, abstehenden Haare sind etwas mehr als doppelt so lang wie das Glied breit, die Spitzen leicht gebogen. Halsschild gut anderthalb mal so breit wie lang, Seiten gegen die Basis fast unmerklich verengt, Punktierung ziemlich dicht und verhältnismässig grob. Flügeldecken stark verkürzt, beinahe glatt, mit vereinzelten, flachen Punkten oder undeutlichen Runzeln versehen, Spitzenrand leicht erhaben. Letztes Abdominaltergit nicht ganz doppelt so lang wie das vorletzte, ziemlich schmal, Spitze schwach ausgerandet.

Länge, 3.5 bis 4.5 Millimeter.

Fundort.—LUZON, Mount Banahao, 2000 Fuss Höhe, 15 bis 18. April, 1914.

Von *M. atripennis* Pic, der laut Beschreibung ebenfalls einfarbige Flügeldecken besitzt, unterscheidet sich *M. brunneus* sp. nov. durch kleinere Gestalt und die einfarbig dunkle Färbung von Kopf (höchstens die vordere Hälfte zeigt manchmal geringere Aufhellung) und Halsschild, Teile die bei *atripennis* Pic gelb gezeichnet sind.

MICROICHTHYURUS MACULICOLLIS sp. nov.

Weibchen.—Schwarzbraun, Kopf gelb bis auf je eine dunkle Makel hinter den Augen in variabler Grösse, Halsschild mit einer gelben Makel auf der vorderen Hälfte, die sich bis zum Vorder-

rande erstreckt. Spitzenrand der Flügeldecken, Koxen und Trochanteren aufgehellt.

Kopf mit den Augen etwas breiter als der Halsschild, kaum wahrnehmbar punktiert, Mittellinie verschwommen. Fühler ungefähr von halber Körperlänge, 3. Glied nur wenig länger als das 2.; 3. bis 11. Glied in der Länge wenig verschieden, die letzten etwas kürzer als die ersten. Behaarung kurz, greis. Halsschild breiter als lang, Seiten parallel, Basal- und Seitenrand sind bei der Art besonders deutlich, Scheibe fast glatt, Punktierung kaum wahrnehmbar. Flügeldecken die Koxen der Hinterbeine nicht erreichend, runzlig skulptiert, dazwischen wenig deutlich punktiert. Letztes Abdominaltergit breit und flach ausgerandet.

Länge, 5.5 Millimeter.

Fundort.—SAMAR, Catbalogan, April, 1915.

Durch die Färbung von Kopf und Halsschild und die einfarbig schwarzen Fühler gut gekennzeichnet. Verwandt mit *M. atripennis* Pic.

MICROICHTHYURUS MEDIOINCRASSATUS sp. nov.

Männchen.—Gelb, nur die Augen und die Fühler von 3. oder 5. Gliede an dunkel.

Kopf mit den Augen etwas breiter als der Halsschild, Stirne glatt, leicht gewölbt, in der Mitte über den Fühlerwurzeln mit einem seichten Längseindrucke versehen. Fühler verhältnismässig kurz, die Spitzen der vorkürzten Flügeldecken kaum überragend, ziemlich lang, teils abstehend, behaart. 3. Glied eine Spur länger als das 2.; 4. Glied fast so lang wie das 2. und 3. zusammengenommen; 5. bis 11. Glied flachgedrückt; 5. und 6. Glied unter sich gleich lang, jedes etwas kürzer als das 4.; 6. Glied wenig breiter als das 5.; 7. bis 9. Glied von gleicher Breite, etwas breiter als das 6., 7. Glied ungefähr so lang wie das 4., 8. Glied wieder etwas kürzer, so lang wie das 6.; 9. Glied etwas länger als das 8., nicht ganz so lang wie das 7., 10. Glied stark verkürzt, fast so lang wie breit, etwas schmäler als das 9.; 11. Glied schmäler als das 10. und so lang wie das 9. Halsschild breiter als lang, Seiten zur Basis schwach verengt. Flügeldecken stark verkürzt, ungefähr um ein Drittel länger als der Halsschild, runzlig, erloschen gewirkt. Letztes Abdominalsegment um die Hälfte länger als breit, Spitze fast gerade abgestutzt, nur schwach ausgerandet.

Länge, 4.5 Millimeter.

Fundort.—Samar, Catbalogan, 14. April, 1915.

Die hellgelbe Färbung sowie die eigentümlich gebildeten Fühler unterscheiden die Art von allen übrigen Arten der Gattung.

MICROICHTHYURUS APICEINCRASSATUS sp. nov.

Männchen.—Färbung und Form des Körpers wie bei der vorangehend beschriebenen Art, von der sie sich nur unterscheidet durch die Bildung der Fühler, die etwas länger (sie überragen die Spitzen der Decken) und verschieden geformt sind. 3. Glied doppelt so lang wie das 2.; 4. bis 7. Glied jedes nur wenig länger als das 3., unter sich ungefähr von gleicher Länge; 8. Glied etwas kürzer und auch dicker als das 7.; 9. bis 11. Glied flachgedrückt, fast doppelt so breit wie das 7.; 9. Glied ungefähr so lang wie das 7.; 10. Glied wieder kürzer, ungefähr so lang wie das 8.; 11. Glied so lang wie das 8.

Die Fühler sind beim Weibchen kürzer, nicht verdickt, das 4. Glied ist am längsten, bis zum 10. nehmen die Glieder in der Länge langsam ab. Letztes Abdominaltergit dreieckig, weniger tief eingeschnitten.

MICROICHTHYURUS ATRIPENNIS Pic.

Microichthyurus atripennis PIC, Philip. Journ. Sci. 25 (1924) 730.

TRYPHERUS BAKERI Pic.

Trypherus bakeri PIC, Philip. Journ. Sci. 25 (1924) 731.

FALSOMALTHINUS PALLIDUS Pic.

Falsomalthinus pallidus PIC, Philip. Journ. Sci. 25 (1924) 731.

FALSOMALTHODES BISBINOTATUS Pic.

Falsomalthodes bisbinotatus PIC, L'Echange 42 (1926) 4.

Der Autor beschreibt die Art wie folgt: "Oblongus, niger antennis ad basin, capite, thorace, pedibus pro parte ad abdomine circa rufis, elytris nigris, ad humeros et apice luteo maculatis."

Fundort.—LUZON; Grösse wird keine angegeben. Zwei mir vorliegende Exemplare mit Fundort NORD-LUZON, Benguet, Haight's Place, 8000 Fuss Höhe, März, 1917, stimmen in der Färbung nicht mit der etwas knapp gehaltenen Originalbeschreibung überein, indem die Fühler (Basalglieder manchmal etwas heller als die Spitzenglieder) und Beine einfarbig gelb sind; var. *filicornis* var. nov. Es ist möglich dass es sich bei dieser Form um eine eigene Art handelt, weshalb ich nachstehend die hauptsächlichsten Merkmale wiedergebe:

Männchen.—Dunkelbraun, Fühler gelbbraun, Basis manchmal etwas heller gelb, Kopf (bis auf die schwarzen Augen), Halsschild mehr oder weniger, Schulterbeulen, Spitzen der Decken

und Beine gelb (Schenkel, besonders die hinteren, manchmal angedunkelt).

Kopf mit den halbkugelförmig hervortretenden Augen breiter als der Halsschild. Fühler langgestreckt, die Spitzen der Decken fast erreichend, 2. Glied etwas länger als das 3., so lang wie das 4.; 5. bis 10. Glied unter sich ungefähr gleich lang, 11. Glied eine Spur länger als das 10., Spitze leicht verdickt. Behaarung fein. Halsschild breiter als lang, fast glatt, nach vorne deutlich verengt, Vorderecken spitz, stark erhaben, Vorder- und Basalrand ungerandet. Flügeldecken drittehalb mal so lang wie breit, die Koxen der Hinterbeine etwas überragend, an der Basis fast glatt, gegen die verdickten und glatten Spitzen in zunehmender Dichte und Tiefe punktiert.

Weibchen.—In der Färbung meist etwas heller, Augen kleiner, Fühler kürzer, vom 4. Glied an in zunehmendem Masse verkürzt. 10. Glied etwas kürzer als das 2.

Länge, 2.8 bis 3 Millimeter.

FALSOMALTHODES FLAVUS sp. nov.

Männchen.—Hellgelbbraun, die Unterseite braun, Kopf und Halsschild rotbraun, die Augen schwarz.

Kopf breiter als lang, mit den Augen so breit wie die Flügeldecken, glänzend, glatt, staubartig behaart, Durchmesser der Augen kleiner als ihr Abstand. Fühler gut so lang wie der halbe Körper, 1. Glied langgestreckt, so lang wie das 2. und 3. zusammengenommen: 2. Glied eine Spur länger als das 3.; 3. bis 10. Glied unter sich gleich lang, jedes knapp doppelt so lang wie breit; 11. Glied um ein Viertel länger als das 10. Halsschild breiter als lang, nach vorne kaum verengt, Vorderecken verdickt, leicht aufstehend, Scheibe glatt, Behaarung fein, greis. Flügeldecken ungefähr doppelt so lang wie an den Schultern breit, in der basalen Hälfte fast glatt, gegen den erhabenen Spitzenwulst mit einzelnen Punkten besetzt, der Spitzenwulst verhältnismässig breit.

Länge, 2 bis 2.5 Millimeter.

Fundort.—NORD-LUZON, Apayao, February, 1918.

Dank der hellen Färbung mit keiner der bisher beschriebenen Arten zu verwechseln, verwandtschaftlich gehört sie in die Nähe von *F. reductocarinatus* Wittmer.

INCERTAE SEDIS

CANTHARIS FLAVIFEMORALIS Blanchard.

Cantharis flavifemoralis BLANCHARD, Voy. Pol. Sud 4 (1853) 67, pl. 5, fig. 3.

MALACHIIDÆ

CARPHURUS RUBROANNULATUS Motschulsky.

Carphurus rubroannulatus MOTSCHULSKY, Et. ent. 8 (1859) 64.

BASILAN, Dezember, 1914. SAMAR, April, 1915. MINDANAO, Port Banga, Januar, 1915.

CARPHURUS DILUTUS Champion.

Carphurus dilutus CHAMPION, Ann. & Mag. Nat. Hist. (9) 12 (1923) 24.

MINDANAO, Dansalan, Februar, 1915; Iligan, Februar, 1915; Kolambugan, Januar, 1915; Mumungan, Februar, 1915; Port Banga, Januar, 1915. SAMAR, Catbalogan, April, 1915. MINDORO, Calapan, Februar, 1916. LEYTE, Santa Cruz, Oktober, 1915; Burauen, Mai, 1915. LUZON, Los Baños, Mai und April, 1914. BASILAN, Dezember, 1914.

CARPHURUS LUZONICUS Champion.

Carphurus luzonicus CHAMPION, Ann. & Mag. Nat. Hist. (9) 12 (1923) 42.

NORD-MINDANAO, Mumungan, Februar, 1915; Surigao, November, 1915; Port Banga, Januar, 1915. LUZON, Mount Banahao, April und Juni, 1914; Los Baños, April, 1914; Imugan, April, 1917.

CARPHURUS FILICORNIS Champion.

Carphurus filicornis CHAMPION, Ann. & Mag. Nat. Hist. (9) 12 (1923) 38.

MINDANAO, Surigao, Mai und August, 1915–1916; Port Banga, Januar, 1915.

CARPHURUS PHILIPPINUS Champion.

Carphurus philippinus CHAMPION, Ann. & Mag. Nat. Hist. (9) 12 (1923) 26.

LUZON, Los Baños, März und April, 1914; Imugan, August, 1917, Montalban, März, 1914; Mount Banahao, April und Juni, Trinidad, Mai, 1914; Butac, Februar, 1917; Naiba, Januar, 1917. BASILAN, Dezember, 1914. SAN MIGUEL, März, 1916. MINDANAO, Mumungan, Februar, 1915; Surigao, Mai, 1915, Port Banga, Januar, 1915, Dansalan, Februar, 1915, Kolambugan, Januar, 1915.

CARPHURUS DAPITANUS Champion.

Carphurus dapitanus CHAMPION, Ann. & Mag. Nat. Hist (9) 12 (1923) 31.

LUZON, Apayao, Februar, 1918; Benguet, Haight's Place, 8000 Fuss Höhe, März, 1917; Imugan, 26. Mai, 1916. MINDORO, Calapan, Februar, 1916.

CARPHURUS NIGRIVENTRIS sp. nov.

Männchen.—Schwarz, ausgenommen der Kopf, die Fühler bis zum 3. oder 5. Gliede und Halsschild rotorange, Flügeldecken mit schwachem bläulichem Schimmer.

Kopf mit den Augen breiter als der Halsschild, Stirne fast glatt, zerstreut punktiert, in der Nähe des Halsschildvorderrandes mit einzelnen Querrunzeln, zwischen den Augen ob der Fühlerbasis undeutlich eingedrückt. Fühler lang, die Mitte der Flügeldecken etwas überragend, vom 3. Glied an scharf gezahnt, die mittleren Glieder unter sich ungefähr von gleicher Länge. Halsschild länger als breit, die Seiten leicht zusammengedrückt sodass die Seitenränder bei der Ansicht von oben nicht sichtbar sind, vor der Basis nur schwach quereingedrückt, in der Basalhälfte verengt, glatt, ziemlich lang abstehend, dunkel behaart. Flügeldecken ungefähr drittehalb mal so lang wie an den Schultern breit, zur Spitze wenig verbreitert, verworren, wenig tief, fast runzlig punktiert, die vier letzten Abdominalsegmente unbedeckt, letztere mit lang abstehenden Haaren besetzt. 1. Tarsenglied der Vordertarsen mit dem üblichen kammartigen Anhängsel auf der Unterseite.

Länge, 3.7 bis 7 Millimeter.

Fundort.—MINDANAO, Port Banga, Januar, 1915. BASILAN, Dezember, 1914.

Die Fühler sind ähnlich gebildet wei bei *C. dapitanus* Champ. Die neue Art unterscheidet sich von ihr durch die Färbung von Kopf und Halsschild, Teile die bei *nigriventris* sp. nov. orangerot, bei *dapitanus* Champ. hingegen schwarz gefärbt sind.

CARPHURUS BRUNNESCENS sp. nov.

Einfarbig gelbraun, nur die Augen schwarz. Fühler manchmal von 8. Gliede an etwas angedunkelt.

Kopf mit den Augen breiter als der Halsschild, so breit wie die Flügeldecken an den Schultern. Stirne glatt, leicht gewölbt, zwischen den Augen mit zwei nebeneinanderliegenden Eindrücken. Fühler von halber Körperlänge, alle Glieder etwas länger als breit, 2. Glied so lang wie das 3., folgende Glieder etwas länger. Halsschild ungefähr so lang wie breit, zur Basis leicht verengt, Basis nur schwach quereingedrückt, fast glatt mit einzelnen Querrunzeln in der Basalhälfte. Flügeldecken gut zwei

mal so lang wie breit, zur Spitze leicht verbreitert, fein, wenig dicht punktiert, matt. Behaarung des ganzen Köpers gelblich.

Länge, 2.3 bis 2.5 Millimeter.

Fundort.—NORD-MINDANAO, Mumungan, Februar, 1915. LUZON, Los Baños, April, 1914.

Von den übrigen hellen Arten durch die geringere Körpergrösse verschieden.

CARPHURUS BASIOBSCURUS sp. nov.

Kopf und Halsschild rötlichgelbbraun, Augen schwarz, Fühler gelbbraun, vom 5. Gliede an dunkel, Flügeldecken weisslich-gelb, bis auf das basale Drittel, das dunkelbraun gefärbt ist, Abdomen dunkelbraun, die vier Vorderbeine gelblich, Hinterbeine dunkel, nur die Knie aufgehellt.

Kopf glatt, glänzend, ziemlich flach, zwischen den Augen nur ganz schwach eingedrückt. Fühler von halber Köperlänge, 2. und 3. Glied unter sich gleich lang, nur wenig länger als breit, 2. Glied etwas dicker als das 3.; 4. Glied eine Spur länger als das 3., so lang wie das 5. und die folgenden bis zum 10. Glied. Halsschild fast breiter als lang, zur Basis gerundet verengt, fast vollständig glatt. Flügeldecken fast drittehalb mal so lang wie an den Schultern breit, fast glatt, nur mit vereinzelten Haarpunkten. Behaarung des ganzen Körpers wenig dicht, greis, nur die Fühler des Männchens sind dicht und kurz behaart.

Länge, 2.5 Millimeter.

Fundort.—SÜD-MINDANAO, Port Banga, Januar, 1915.

C. flavoapicalis Pic ist ganz ähnlich gefärbt, doch unterscheidet sich die neue Art durch kleinere Gestalt und das Fehlen der Querrunzeln an der Stirne und Halsschildbasis.

CARPHURUS BASILANUS Champion.

Carphurus basilanus CHAMPION, Ann. & Mag. Nat. Hist. (9) 12 (1923) 21.

CARPHURUS SUMATRENSIS Pic.

Carphurus sumatrensis PIC, L'Echange 22 (1906) 57.

Wird von Champion als auch auf den Philippinen vorkommend gemeldet.

CARPHUROIDES CORPORAALIANUS sp. nov.

Männchen.—Gelborange, die Augen, die Fühler vom 3. Gliede an, die Tibien und Tarsen dunkel, der Halsschild geht in der Färbung stärker ins rötliche über. Ein Exemplar hat braunen Kopf, dunkles Schildchen und dunkle Spitzen der Flügeldecken.

Kopf mit den Augen ungefähr so breit wie der Halsschild, ziemlich dicht und tief punktiert, an der Basis stärker punktiert

als zwischen den Augen, hier mit einem V-förmigen Eindrucke versehen, über jedem Auge eine lange Borste. Fühler die Schulterbeulen nur um weniges überragend, vom 4. Gliede an stark gezahnt, 8. Glied etwa um die Hälfte breiter als lang, 4. Glied kaum breiter als lang; 3. Glied knötchenförmig, in Form und Grösse vom 2. wenig abweichend. Halsschild etwas breiter als lang, glatt, nur mit vereinzelten kaum sichtbaren Haarpunkten, Basalrand deutlich abgesetzt, Seitenrand an der Basis deutlich, gegen die Vorderecken erlöschend, jederseits vor den Basalecken eine lange, aufgerichtete Borste, Flügeldecken ungefähr zwei mal so lang wie breit, fast glatt, vier bis fünf Abdominaltergite unbedeckt.

Länge, 3.5 bis 3.8 Millimeter.

Fundort.—NORD-MINDANAO, Mumungan, Februar und März, 1915.

Die hellen Flügeldecken, deren Spitzen dunkel sind, kennzeichnen die Art und lassen sie leicht von den übrigen unterscheiden.

Die nachfolgend beschriebenen drei Arten, die ich vorläufig in die Gattung *Carphuroides* Champ. stelle, bilden ein Gruppe die vielleicht später von ihr abgetrennt werden muss. Der Halsschild ist ähnlich geformt wie bei *Carphuroides*, es fehlt ihm also der Quereindruck an der Basis, der für die Gattung *Carphurus* Er. charakteristisch ist; an Stelle der einzelnen Borste in der Nähe der Basalecken sind die Seiten mit einer grösseren Anzahl, drei bis acht, dicken Borsten besetzt. Auch der Kopf weist an Stelle der Superorbitalborste eine grössere Anzahl Borsten auf, die über die ganze Kopfoberfläche verteilt sind. Die Flügeldecken sind mit mehr oder weniger dicken, schräg abstehenden oder gerade aufgerichteten, borstenähnlichen Haaren, neben der dichteren und kürzeren Grundbehaarung, versehen. Die Spitze der Tibien weist dicke und lange Enddornen auf.

CARPHUROIDES? PALLIDIPES sp. nov.

Schwarz, Fühler und Beine bis auf die etwas angedunkelte Basis der Schenkel, gelb. Manchmal sind die letzten Fühlerglieder mehr oder weniger angedunkelt.

Kopf mit den Augen schmäler als der Halsschild, fast glatt, vereinzelt punktiert, vor jeder Fühlerwurzel mit einem Längseindruck gegen den Clypeus. Fühler von nicht halber Körperlänge, 2. bis 4. Glied ungefähr gleich lang, jedes so lang wie breit; 5. Glied eine Spur länger als das 4.; 6. Glied deutlich länger als das 5., so lang wie die folgenden bis zum 10. Glied. Halsschild fast glatt, mit vereinzelten Haarpunkten, alle Ecken ver-

rundet, Basalecken stärker verrundet als die vorderen. Flügeldecken verhältnismässig lang, nur die zwei oder drei letzten Abdominalsegmente unbedeckt lassend, die ganze Oberfläche lederartig gerunzelt.

Länge, 2.2 bis 2.5 Millimeter.

Fundort.—SAMAR, Catbalogan, 15. April, 1915.

CARPHUROIDES? CORIACEIPENNIS sp. nov.

Schwarz, Halsschild und Flügeldecken mit schwachem grünlichem Metallschimmer, Fühler gelb, vom 4. oder 5. Glied an dunkel, Beine dunkel, höchstens die Vordertibien etwas aufgehellt.

In der Körperform der vorangehenden Art sehr ähnlich, grösser, Flügeldecken drei oder vier Abdominalsegmente unbedeckt lassend.

Länge, 3.5 bis 3.8 Millimeter.

Fundort.—SÜD-MINDANAO, Port Banga, Dezember, 1914.

CARPHUROIDES? VICINUS sp. nov.

Einfarbig schwarz, nur die drei oder vier ersten Fühlerglieder und die Vordertibien gelb.

Kopf mit den Augen nicht ganz so breit wie der Halsschild, zwischen den Augen mit drei undeutlichen Eindrücken, Stirne zerstreut punktiert. Fühler nicht ganz so lang wie der halbe Körper. Halsschild mit einzelnen Haarpunkten, dazwischen glatt. Flügeldecken zerstreut, wenig tief punktiert. Drei oder vier letzte Abdominalsegmente unbedeckt.

Länge, 2.5 Millimeter.

Fundort.—NORD-MINDANAO; Mumungan, Februar, 1915.

Die drei in die Gruppe *Carphuroides?* fallenden Arten lassen sich wie folgt unterscheiden:

1. Alle Tibien und Tarsen gelb..... *C.? pallidipes* sp. nov.
   Wenigstens die Tibien und Tarsen der Mittel- und Hinterbeine dunkel.. 2.
2. Flügeldecken lederartig gerunzelt, beziehungsweise gewirkt, grössere Art mit leicht grünlich schimmerndem Halsschild und Flügeldecken. *C.? coriaceipennis* sp. nov.
   Flügeldecken punktiert, kleinere Art, Halsschild und Flügeldecken schwarz ohne Metallglanz..... *C. ? vicinus* sp. nov.

MYRMECOPHASMA (LUZONOTROGLOPS) CARINATA Pic.

Myrmecophasma (*Luzonotroglops*) *carinata* PIC, Bull. Soc. Ent. France (1924) 230.

NORD-LUZON, Benguet, Haight's Place, 8000 Fuss Höhe, März, 1917; Kalinga, Balbalasang, 4000 bis 5000 Fuss Höhe, März, 1918.

Ein Exemplar von der Insel Mindanao, Surigao, 25. Mai, 1915, unterscheidet sich von den Stücken von Luzon durch eine weissliche Quermakel auf den Flügeldecken, die sich von Naht zu Naht erstreckt, und hellere Fühler; ab. *discovittata* nov.

LAIUS SUBMARINUS Champion.

Laius submarinus CHAMPION, Ann. & Mag. Nat. Hist. (9) 8 (1921) 195, 196, figs. 9, 9*a*.

MINDANAO, Port Banga, Dezember, 1914; Surigao, November, 1915.

LAIUS BAERI Fairmaire.

Laius baeri FAIRMAIRE, Ann. Soc. Ent. France 67 (1898) 389.

LUZON, Mount Alban, März und April, 1915; Laguna, Pagsanjan, März, 1914.

LAIUS RECTEFASCIATUS Champion.

Laius rectefasciatus CHAMPION, Ann. & Mag. Nat. Hist. (9) 8 (1921) 197.

NORD-MINDANAO, Dansalan, 5. Februar, 1915, 1 Weibchen.

LAIUS SUBDENTATUS Champion.

Laius subdentatus CHAMPION, Ann. & Mag. Nat. Hist. (9) 8 (1921) 201.

SÜD-MINDANAO, Port Banga, 1. bis 12. Januar, 1915.

LAIUS QUADRISTRIGATUS Champion.

Laius quadristrigatus CHAMPION, Ann. & Mag. Nat. (9) 8 (1921) 203.

LUZON, Bontoc, Mount Polis, 2400 Fuss Höhe, Februar, 1917, 1 Weibchen.

LAIUS CONFLUENS sp. nov. Textfig. 1.

Männchen.—Kopf, Vorderbeine und die beiden ersten Fühlerglieder gelborange, Halsschild orangerot, Fühler vom 3. Gliede an braun, Flügeldecken teilweise, Hinterleib und die vier Hinterbeine schwarzbraun bis schwarz, jede Decke mit zwei weissen queren Makeln versehen, die wohl die Seitenränder, nicht aber die Naht erreichen, die obere Makel besteht aus einem queren, regelmässig breiten Bande, die untere aus zwei Flecken, die miteinander durch einen schmalen Kanal verbunden sind.

Kopf mit den Augen so breit wie der Halsschild, Augen ziemlich stark hervortretend, Scheibe fein chagrinartig skulptiert, mit angedeuteter Mittellinie, die am Scheitel und zwischen den Augen am deutlichsten ist und gegen den Clypeus langsam erlischt. Kopf ziemlich flach, nur gegen den Clypeus sind die

Seitenränder der Wangen, ob der Fühlerwurzeln und dem Vorderrand der Augen, leicht kantenartig erhaben. Der ganze Kopf mit den Wangen ist greis, ziemlich dicht behaart. Fühler die Schulterbeulen etwas überragend, 1. Glied in der Form einer länglichen Keule, zur Spitze stark verdickt; 2. Glied verhältnismässig flach, ungefähr doppelt so lang wie breit, auf der Oberseite tief ausgehöhlt, Vorder- und Hinterrand (auf der Aussenseite des Fühlers) des fast muschelartig geformten Gliedes leicht ausgezogen, besonders deutlich der Vorderrand, der in stumpfer Spitze ausgezogen und nur wenig über den Rand der Aushöhlung geschlagen ist; 3. bis 10. Glied schnurförmig, jedes länger als breit. Halsschild nur wenig breiter als lang, zur Basis stärker als nach vorne verengt, fein chagrinartig gewirkt, matt, Behaarung kurz, greis. Flügeldecken ungefähr drittehalb mal so lang wie an den Schultern breit, nach hinten nur wenig verbreitert, Oberfläche matt, Punktierung dicht, fein, fast körnig. Vorderschenkel kurz vor der Spitze schwach ausgehöhlt.

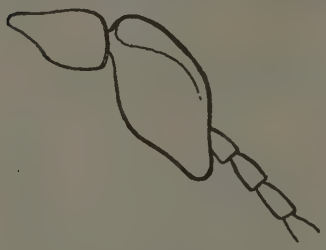

FIG. 1. *Laius confluens* sp. nov.; Fühler des Männchens.

Länge, 2.5 bis 2.7 Millimeter.

Fundort.—MINDORO, Calapan, 10. Februar, 1916.

Durch die rote Färbung von Kopf und Halsschild ist die Art mit *L. quadristrigatus* Champ. verwandt; sie unterscheidet sich durch has Fehlen des Seitenzahnes am Halsschilde beim Männchen, die Färbung der Flügeldecken, deren Spitzen mit zwei weissen ineinanderfliessenden Makeln versehen sind und die Bildung der ersten beiden Fühlerglieder, deren 1. Glied nicht in eine Spitze ausläuft und die Erweiterung des 2. Gliedes an der Basis auf der Innenseite nicht in zwei Spitzen ausgezogen ist.

LAIUS BOETTCHERI sp. nov. Textfig. 2.

Schwarz bis schwarzbraun, die Unterseite des Kopfes, die Wangen, die beiden ersten Fühlerglieder teilweise und die Vorderschenkel mehr oder weniger rötlichgelb gefärbt, Flügeldecken mit je drei gelblichweissen Makeln, die erste, grössere, quere Makel in der vorderen Hälfte berührt weder die Naht noch den Seitenrand, und zwei kleinere, fast kreisrunde Makeln, dicht nebeninander, kurz vor der Spitze, deren äussere den Seitenrand

berührt und deren innere von der Naht durch einen schmalen Saum getrennt ist.

Männchen.—Kopf eher länglich, mit den stark hervortretenden, halbkugelförmigen Augen so breit wie der Halsschild, Augen gegen die Stirne durch eine feine, leicht erhabene Leiste abgesetzt, bis zum Clypeus fein körnig punktiert, von der Stirne bis zur Hälfte der Kopflänge mit einer feinen Längskerbe, Wangen jederseits ziemlich tief eingedrückt, Grund glatt. Fühler die Schulterbeulen erreichend, 1. Glied fast länger wie an der Spitze breit; 2. Glied stark verdickt, auf der Oberseite ausgehöhlt, auf der Innenseite ist der Seitenrand in einen gegen den Kopf gerichteten Zahn oder Dorn ausgezogen, der Aussenrand der Erhebung its kurz vor der Spitze leicht ausgerandet; 3. Glied fast um die Hälfte kürzer als das 4; 5. Glied eine Spur länger als das 4., so lang wie die folgenden Glieder bis zum 9.; 10. Glied etwas länger als das 9. Halsschild ungefähr so lang wie breit, gegen die Basis, von der Mitte an leicht verengt, körnig, fein und dicht punktiert, greis, kurz behaart. Flügeldecken zur Spitze leicht verbreitert, matt, in der gleichen Art wie der Halsschild punktiert, kurz und greis behaart. 2. Tarsenglied ohne Auszeichnungen.

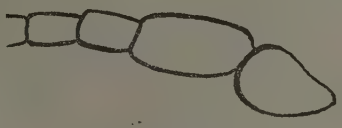

FIG. 2. *Laius boettcheri* sp. nov.; Fühler des Weibchens.

Weibchen.—In der Körperform dem Männchen sehr ähnlich, Wangen nicht eingedrückt, 2. Fühlerglied so dick wie das 1., aber länger, walzenförmig.

Länge, 2.5 bis 2.7 Millimeter.

Fundort.—NORD-MINDANAO, Dansalan, 6. und 13. Februar, 1915.

Die neue Art, die durch ihre je drei Makeln auf den Flügeldecken und den Kopf, dessen Unterseite rötlich gefärbt ist, leicht erkenntlich ist, gehört in die Verwandtschaft von *L. guttatus* Pasc. und *L. hexastigma* Champ.

LAIUS GUTTATUS Pascoe.

Laius guttatus PASCOE, Journ. ent. 2 (1866) 448.

Die Art wurde nach weiblichen Exemplaren von der Insel Batchian beschrieben. Von Luzon, Bontoc, Mount Polis, 2400 Fuss Höhe, Februar, 1917, liegen mir fünf Weibchen vor, die ich, bis das Männchen aufgefunden wird, vorläufig zu *L. guttatus* Pascoe stelle. Der Halsschild der Tiere von Luzon weist den für diese Art charakteristischen Seitenzahn auf, der allerdings

bei einzelnen Exemplaren fast ganz verschwindet und nur noch angedeutet ist. Die Flügeldecken sind tiefschwarz und weisen einen schwachen bläulichen Schimmer auf, die weissen Punkte sind ziemlich klein, im Gegensatz zu den anderen Arten nur ganz vereinzelt mit Punkten versehen, die weissen Flächen erscheinen als glatte Flächen zwischen der übrigen verhältnismässig dicht punktierten, dunkeln Oberfläche, die Behaarung der Decken ist doppelt, fein kurz anliegend und lang schwarz abstehend. Es ist sehr leicht möglich dass es sich hier um eine von *guttatus* Pasc. spezifisch verschiedene Art handelt, die Beschreibung ist leider zu kurz gehalten um einen Vergleich zu ermöglichen. Flügel sind vorhanden. Champion stellt das Vorhandensein von Flügeln in Frage.[2]

LAIUS DENTATITHORAX Pic.

Laius dentatithorax PIC, Mél. exot.-ent. 25 (1917) 5.

LAIUS SEMIDEPRESSUS Pic.

Laius semidepressus PIC, Mél. exot.-ent. 25 (1917) 6.

LAIUS ALBOARCUATUS Champion.

Laius alboarcuatus CHAMPION, Ann. & Mag. Nat. Hist. (9) 8 (1921) 196.

LAIUS SEMPERI Champion.

Laius semperi CHAMPION, Ann. & Mag. Nat. Hist. (9) 8 (1921) 201.

LAIUS FALCIFER Champion.

Laius falcifer CHAMPION, Ann. & Mag. Nat. Hist. (9) 8 (1921) 204.

HAPALOCHRUS LUZONENSIS Pic.

Hapalochrus luzonensis PIC, Mél. exot. ent. 10 (1914) 15.

LUZON, Guadalupe, bei Manila, 29. Juni, 1915; Imugan, 30, Mai, 1916.

INCERTAE SEDIS

MALACHIUS RUFIVENTRIS Eschscholtz.

Malachius rufiventris ESCHSCHOLTZ, Entomogr. 1 (1822) 64.

Vielleicht identisch mit *Carphurus rubroannulatus* Motsch.

DASYTIDÆ

HAPLOCNEMUS PHILIPPINUS sp. nov.

Dunkelbraun bis schwarz, nur die beiden ersten Fühlerglieder und die Tarsen rötlich.

[2] Ann. & Mag. Nat. Hist. (9) 7 (1921) 340.

Kopf und Halsschild fein chagrinartig gerunzelt, matt, dazwischen zerstreut, wenig tief, ungefähr ein Drittel so tief und grob als die Flügeldecken punktiert. Fühler die Mitte der Decken nicht ganz erreichend, 2. Glied knötchenförmig, 3. bis 11. Glied unter sich ungefähr von gleicher Länge, 3. Glied fast parallel, zur Spitze nur schwach verbreitert, 4. Glied deutlich gezahnt, 5. Glied zur Spitze noch etwas stärker verbreitert als das 4. Halsschild ungefähr anderthalb mal so breit wie lang, Seiten nach vorne schwach gerundetverengt, Seitenrand an der Basis etwas breiter als an den Vorderecken, mit vereinzelten kaum sichtbaren Einkerbungen versehen. Flügeldecken nur wenig breiter als der Halsschild, ungefähr drittehalb mal so lang wie breit, stark glänzend, Punktierung ausserordentlich grob und tief, Wulste zwischen den Punkten kleiner als der Durchmesser eines Punktes, an den Schultern und an den Spitzen ist die Punktierung weniger dicht und tief und die glatten Zwischenräume sind grösser als der Durchmesser eines Punktes.

Länge, 3.5 bis 3.7 Millimeter.

Fundort.—LUZON, Nueva Vizcaya, Imugan, 4000 Fuss Hone, 3. Juni, 1916.

Durch den matten, chagrinartig gewirkten Kopf und Halsschild, die in starkem Kontrast zu den glänzenden, tief punktierten Flügeldecken stehen, gut erkenntlich.

PRIONOCERIDÆ

PRIONOCERUS CÆRULEIPENNIS Perty.

Prionocerus cæruleipennis PERTY, Obs. Col. Ind. Or. (1831) 33.

MINDANAO, Kolambugan, Januar, 1915; Dansalan, Februar, 1915; Mumungan, Juli, 1915; Iligan, Februar, 1915; Surigao, Port Banga, Dezember, 1914. MINDORO, San Teodoro, Januar, 1916. LUZON, Manila, April, 1915. MASBATE, Aroroy, August, 1917. BASILAN, Dezember, 1914.

PRIONOCERUS BICOLOR Redtenbacher.

Prionocerus bicolor REDTENBACHER, Reise Novara 2 (1868) 109.

NORD-MINDANAO, Dansalan, Februar, 1915.

IDGIA LUZONICA Pic.

Idgia luzonica PIC, Bull. Soc. Ent. France (1924) 230.

NORD-LUZON, Kalinga, Lubuagan, 3500 Fuss Höhe, Februar, 1917.

IDGIA BAKERI Pic.

Idgia bakeri PIC, L'Echange (1920) 8, *hors-texte.*

NORD-MINDANAO, Mumungan, März, 1915. LUZON, Mount Bulusan, Oktober, 1917. NORD-MINDORO, San Teodoro (Subaen), Januar, 1916.

Einzelne Exemplare weichen durch einfarbig gelbe Flügeldecken von der Stammform ab; ab. *testaceipennis* nov.

IDGIA ROUYERI var. MINDANAONA Pic.

Idgia rouyeri var. *mindanaona* PIC, in litt.

NORD-MINDANAO, Mumungan, Februar und März, 1915.

IDGIA LONGICOLLIS Pic.

Idgia longicollis PIC, L'Echange (1925) 17, *hors-texte.*

ILLUSTRATIONEN

TEXTFIGUREN

CONGENITAL EXTERNAL AND INTERNAL ANOMALIES IN A FOAL

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THREE PLATES

Malformations of the extremities are not infrequently met with in animals, but two or more similar abnormalities in one individual are very rare. The monstrosity reported in this paper, besides having the congenital defects of the anterior limbs and other external abnormalities, also presented marked anomalies of the digestive and urogenital systems. The study of this specimen represents an extension of our limited knowledge of anatomical aberrations and the factors causing disturbances in the normal process of orderly development.

In the preparation of this manuscript, the works of Mall(8, 9) on the frequency of localized anomalies in human embryos and the origin of human monsters, Ziegler's(16) classification of abnormalities, and textbooks in anatomy and embryology have been consulted. Other investigations of monstrosities and abnormalities by various authors, like Watt,(14) Sumulong,(12) Carreon,(3) Kaura,(7) Crew and Panikkar,(4) and Fitzgerald(5) have also been referred to.

MATERIAL

The foal was received at noon, November 10, 1938. According to a letter received from Ibaan, Batangas Province, dated November 9, 1938, the animal was foaled November 8, 1938, after a gestation period of eleven months. The parturition was normal and the foal was born alive. It died on the third day, November 10, 1938, and was sent to the College. The dam was a grade animal and the sire was one of the breeding stallions of the Bureau of Animal Industry. The owner of the dam was Mr. Juan A. Mariño of Batangas Province.

The living attitude of the animal could not be determined, as it was already dead when received, but judging from the bed sores found on the left face and left side of the trunk, the front and

left surfaces of the thigh, the animal must have lain on its left side most of the time after delivery.

If the animal had been alive and able to support its weight on the two hind legs, its standing attitude would have simulated very much that of a kangaroo.

SURFACE ANATOMY

The coat was bay, with a white sock on the left hind limb and an irregular white marking (star) on the frontal region.

Viewed from the sides and front, the animal seemed to lack both forelimbs. On closer observation, however, the distal extremities of the scapulæ on both sides could be noticed and could be felt subcutaneously as pointed projections. They were located more anteriorly than in normal individuals. On the left side, in addition to the small shoulder, a winglike segmented structure, representing the other parts of the left limb, could be observed posteriorly and below the scapula. Palpation showed that this winglike structure did not articulate with the distal end of the scapula. The upper part, which was loosely attached to the thorax, was somewhat oval, while the middle and lower portions were elongated and very slender, the former being the shorter and smaller of the two. At the distal end, and concealed by hair, was a horny nodule the size of a grain of corn.

The anterior part of the thorax was depressed on the right side, while the left side was correspondingly convex. The right side of the neck was also slightly concave, and the left side was convex.

Viewed from behind, the complete absence of both tail and anus was very noticeable. The vortex of the hair was present at the region where the anus normally appears. A depression between the tubera ischii could be palpated. Below the vortex of hair was an opening that would admit an ordinary probe. The orifice was situated on a rounded elevation about the size of a 10-centavo piece, which was pigmented and surrounded by a tuft of fine, short hairs. Two moderately developed teats were located normally.

The croup as a whole was almost horizontal throughout, its length exhibiting a slight depression at its middle. The buttocks were also wide, laterally and anteroposteriorly, roughly resembling the buttocks of a monkey.

The head, trunk, and pelvic limbs were normally developed.

The length of the body, measured from the poll to the point of the buttock, was 34 inches, and the height, measured with the

animal made to assume a normal standing position, 27.25 inches. The weight of the foal was 42.98 pounds.

INTERNAL ANATOMY

The following account includes only the descriptions and discussions of the deformed parts, omitting entirely the anatomy of the structures that were apparently normal.

Skeleton.—The vertebral column after maceration by the rapid method of Green(6) and drying for 2 days, together with the ribs, weighed 750 grams. The length, taken from the atlas to the end of a fibrocartilagenous prolongation representing the coccygeal vertebræ (which were absent) was 25 inches. The vertebral formula was $C_7T_{18}L_6S_2Cy_0$. There are only 33 vertebral structures, in contrast to Sisson's(11) normal number in the horse, which is 54, taking 18 as the average number of coccygeal vertebræ.

The cervical vertebræ were normally developed with the exception of the slight bending of the 6th and 7th cervical vertebræ to the left of the longitudinal axis. The longitudinal axis of the thoracic region was crooked, and, from the 1st thoracic vertebra to the 6th, curved outward and backward towards the left side away from the median line. The 7th and 8th vertebræ were directed backward and inward towards the median plane, and finally the 9th to the 18th vertebræ were directed almost straight backward, showing a slight curve at about the 12th and 13th vertebræ towards the right side across the median plane.

The bodies of the thoracic vertebræ were normal, except those of the 6th and 7th which were greatly compressed on the right halves anteroposteriorly; this deformation may have been brought about by the curvature in this region. The transverse processes on the left side were normally developed, while those on the right side, where the bones were crowded and depressed, were undeveloped. The thoracic spines were also normal in number and in form. With regard to the obliquity of the spines, the following was observed: From the 1st spine to the 12th the direction was backward and to the right in such a way that the summits of the spines overhung their bodies, especially in the region of the 2d to the 10th spines. The shafts of the 3d, 4th, and 5th spines, and those of the 6th and 7th were completely fused.

The lumbar vertebræ were normal, save for a curved direction towards the left side at the region of the 2d and the 4th lumbar vertebræ.

The sacrum was very incomplete, consisting of only 2 vertebræ. The first vertebra articulated with the wings of the ilium. It was almost as large as the last lumbar, while the 2d was only about one half the size of the first.

There was no developed coccygeal vertebra. However, there was a sort of a fibrocartilagenous tissue connected to the last segment of the sacrum which undoubtedly represented the rudiments of the coccygeal vertebræ.

The vertebral curve was very abnormal. From the 1st to the 7th cervical it was almost horizontal, with a very slight concavity dorsally. From the 1st thoracic to the 4th and 5th, it was concave ventrally, and from there to about the 9th, slightly concave dorsally. From the 10th to the 4th or 5th lumbar it was concave ventrally, and the rest presented a complete change of course, that is, it was directed upward and backward or concave dorsally.

Ribs.—The ribs were normal in number, there being 18 pairs. They were in general smaller and slenderer than normal. The curvature of the ribs on the right side was apparently normal on the 1st and 2d, and on the 10th to the last. The 3d to the 9th were depressed. The 3d, 4th, 5th, and 6th were practically fused at their sternal extremities.

The ribs on the left side appeared normal and well sprung. They were larger and stronger than those on the right side.

On account of the deformity, which was largely confined to this region at about the level of the 5th to the 6th ribs, the thorax, viewed from the front, did not show a truncated conical form but instead presented a shape like the outline of a mango fruit.

Bones of the anterior limb.—The bones representing the right and left anterior limbs were a scapula on each limb; on the left side there were additional 4 segments of bones, arranged in a winglike manner. Therefore, of both anterior limbs there were only 6 bones present, 1 on the right side and 5 on the left side.

Scapulæ.—After drying the right scapula was 3.75 inches long and 3 inches wide, and weighed 17 grams. It was more developed, wider, and heavier than the left. The scapular spine was prominent, and presented a distinct tuber spinae. The tuber scapulae was larger than that of the left bone. The medial surface was shallow. At about the junction of the middle and lower thirds of this surface was found the nutrient foramen, about 0.5 inch from the posterior border. It presented no articular glenoid cavity, on account of the fact that the rest of the

bones of the limb were not present, so that the articular angle was represented by a blunt-pointed termination.

The left scapula, on the other hand, was 3.76 inches long and 2.75 inches wide, and weighed 15 grams. It was slightly longer but a little narrower and not as heavy as the right scapula. The scapular spine was not as prominent, and the tuber spinae was indistinct. The medial surface was deeply concave, and presented the nutrient foramen at about the middle of this surface and at about the same distance as the right, to the posterior border. Also, there was no articular cavity, instead the part terminated in a somewhat pointed projection.

Winglike structure.—The term "winglike structure" is used here for convenience, inasmuch as the structure consisted of 4 bony segments, referred to above, simulating the appearance of a bird's wing. This structure was located on the left side, just below the left scapula. Together these 4 bony segments weighed 5 grams.

The uppermost segment was the largest, and had the form of a miniature scapula minus its elaborations. On the vertebral border it presented a cartilage. It did not articulate with the left scapula, but like the latter was also attached to the thorax by muscular and connective tissues. The 2d segment was in the form of a flattened disc about the size of the head of a thumb tack. The 3d segment was a round nodule the size of a large mongo seed. The 4th segment was the largest, and was in the form of a rod about 4 inches long, whose ends were somewhat enlarged and rounded. Its distal end was connected by about 0.5 inch cartilagenous tissue to a nodular tissue with hairs, most probably representing the hoof.

Muscles.—The salient characteristics of the muscles in the abnormal parts are briefly described as follows:

Muscles of the left shoulder girdle.—The cutaneous omobrachialis had a thick anterior part where the muscle fibers were almost vertical up to the distal end of the scapula. The posterior part was very thin, directed upward and backward, fading out to be blended with the fascia.

The trapezius thoracalis was very thick, and its attachment to the spine of the scapula was very thick and strong.

The rhomboideus cervicalis was also thick.

The latissimus dorsi was very well developed below the withers. It was thick distally and attached to the posterior angle of the scapula, besides being attached to the medial border of the up-

per part of the first bony segment described before. It was blended closely with the teres major and with the posterior deep pectoral.

All the pectoral muscles in general were well developed, particularly the anterior and posterior superficial. The scapular part of the anterior deep thinned out at the posterior third of the scapula, while the posterior deep formed a thick, rounded mass in front of the anterior end of the supposed humerus where it was attached. It was also attached to the distal third of the medial surface of the scapula, blending with a thin subscapularis.

The serratus cervicis was well developed but narrower from above downward.

The brachiocephalicus blended below with the loose connective tissue and fascia in front of the shoulder, but to a greater extent with the superficial pectoral, besides being attached to the lateral side of the distal point of the scapula.

Muscles of the left shoulder.—In general all the muscles of the shoulder that were observed were very small and underdeveloped.

The supraspinatus was wholly confined to the scapula where it was attached below to the pointed distal end of the scapula.

The infraspinatus was thick superiorly, but only extended as far as the lower third of the fossa.

The deltoideus was very thin. The teres minor could not be distinguished as well as the capsularis and coraco brachialis. The teres major was thick and blended very well with the latissimus dorsi. The subscapularis was very thin and poorly developed.

Muscles of the left arm.—With the exception of the long head of the triceps, which was very slender and loosely attached to the connective tissue, no muscles of the arm could be identified, but an irregular sheet of muscular tissue and connective tissue surrounded the first bony segment.

Muscles of the forearm and manus.—There were no muscles, but connective tissue and fascia covered the lower bony segments.

Muscles of the right shoulder girdle.—The cutaneous omobrachialis had a less developed vertical part, and the horizontal part was blended to the latissimus dorsi and skin. The brachiocephalicus was blended with the two superficial pectoral muscles and fascia surrounding the tip of the scapula. The serratus cervicis was very much elongated from front to back. The rhomboideus cervicalis was strong and attached to the anterior edge, and both surfaces of the big scapular cartilage. The pectoral

muscles were less separable than those of the left side, and poorly developed. The latissimus dorsi was thin at its origin and blended with the teres major and cutaneous omobrachialis, and loosely attached to the posterior border of the scapula. The trapezius was very thin, and a very weak fascia connected it with the scapular spine.

Muscles of the right shoulder.—In general the muscles of the right shoulder were less developed than those of the left. Only the supraspinatus and infraspinatus were distinct.

Below this region there were no more muscles, just as there were no bony segments representing the rest of the right appendage.

BLOOD AND NERVE SUPPLIES OF THE DEFORMED PARTS

The left anterior appendage.—The brachial artery was observed to extend as far as the second bony segment. The external thoracic artery was large and extended backward to the abdominal muscles. The suprascapular and subscapular branches were very short, but the thoracodorsal branch of the latter was large. No other named collateral branches were observed, but many fine muscular branches were present.

The brachial plexus was fully developed, and all the eleven branches coming from it could be identified. The anterior thoracic or pectoral nerves were large, and had several well-defined branches to the pectoral muscles and the distal end of the brachiocephalicus. The median and ulnar nerves could be traced down the supposed region of the arm where the muscular tissue and connective tissue only formed a bundle around the bone.

The right anterior appendage.—The suprascapular branch of the branchial artery was large, but the subscapular was very much smaller and the rest of the branches were wanting. The brachial artery itself terminated in a fine blood vessel in the fibromuscular tissue surrounding the distal end of the scapula.

The brachial plexus appeared incomplete. The ventral branches of the last two cervical nerves largely formed the brachial plexus. The branches emanating from the plexus that were observed present were the long thoracic, external thoracic, pectoral, subscapular, and a large suprascapular.

Other abnormalities that were observed in the circulatory system were the presence of two large posterior mesenteric arteries. The internal iliac or hypogastric arteries were very much larger than the external iliac arteries. The middle and lateral coccygeal arteries were absent.

VISCERAL ORGANS

Digestive system.—The stomach, small intestines, and large intestines were normally developed and were in normal position and relation, save for the terminal part of the colon which was connected with the genital apparatus. There was no independent anus.

The liver and pancreas were normally developed and located, whereas the spleen was situated more forward, and the left lateral and central lobes of the liver overlapped about half of its parietal surface.

The terminal part of the small colon joined the posterior part of the urogenital tract.

Urogenital system.—Two kidneys were present, but were almost completely divided by transverse fissures into two anterior and two posterior lobes. The urinary bladder was elongated and thick-walled. The uterus and round ligaments were normal. The urinary bladder, by means of a short urethra, communicated with the distal tapering portion of the urogenital tract at about the same level where the colon joined the latter.

Two large ovaries, each the size of a santol seed, were present. The fallopian tubes as well as the horns of the uterus were observed to be somewhat thin-walled. The tapering thin-walled portion of the urogenital tract, which on dissection was found to be the phallic portion of the urogenital sinus, was continued by an elongated tube extending to the external genital orifice. This portion resembled the penis, as it coarsed around and ventrally to the ischial arch. On dissection this extrapelvic genital tract appeared enclosed by a pigmented integument, probably the prepuce, and opened on a minute orifice imbedded in an elongated enlargement about 1 cm long, simulating more or less the glans penis.

The uterus and vagina had not completely differentiated. The body of the uterovaginal canal was divided into dorsal and ventral cavities, communicating only by a small opening near a circular fold representing the hymen. The left horn of the uterovaginal canal lead into what may be called the dorsal half, and the right horn opened into the ventral cavity, the other half of the uterovaginal canal. Into the posterior cavity, separated in front from the uterovaginal canal by the hymen, opened the urethra on the right side and the colon on the left side. This thin-walled cylindrical sac, which was the undifferentiated phallic portion of the urogenital sinus, abruptly thickened near the is-

chial arch and continued by the penislike structure already described in the preceding paragraph.

COMMENTS

According to its history, the animal was a full-term foal. The measurements obtained showed that it was not underdeveloped or stunted. Its weight, however, lacks about 20 pounds of the normal birth weight of foals as found by Villegas.(13) The discrepancy may be explained by the almost complete absence of anterior appendages and tail in the animal.

The presence of 2 ovaries, fallopian tubes, and uterovaginal canal caused this foal to be classified as female. However, the external genital organ was a long, narrow, firm structure curving around ventrally to the ischial arch, with the external urethral orifice at the center of an elongated prominence. This structure resembled more the penis and its prepuce, the glans penis being represented by an elongated prominence about 1 cm long. The presence of this penislike external genital made the foal a false hermaphrodite (pseudohermaphrodismus femininus externus). Embryologically this condition may be explained by the rapid development of the indifferent anlage, the genital tubercle. It should be remembered, according to Arey,(1) that organs not only developed from definite primordia or anlagen, but also at a definite time. And if differentiation does not take place at that moment, there will be no perfect development, and the organs in turn may be depressed by other organs which have acquired the power to develop dominantly.

The other abnormalities, such as the intercommunication of the digestive tract and urogenital sinus, may be explained by the persistence of the cloaca due to the incomplete development of the urorectal fold which ultimately separates the rectum dorsally and the urogenital sinus ventrally. However, the vesicourethral portion of the urogenital sinus differentiated into urinary bladder and part of the urethra, whereas the phallic portion remained undifferentiated, persisting as the cloaca where the colon and urethra opened. As a consequent anomaly, the anal membrane failed to rupture, producing an imperforate anus. The division of the uterovaginal canal into two compartments might have been due to the failure of the distal wall between the two Müllerian ducts to degenerate. These two ducts normally fuse caudally and the intervening wall between them disappears to constitute the anlage for the uterus and vagina. Bailey and Miller(2)

termed this potential wall condition throughout the uterine and vaginal portions 'uterus didelphys.'

The lobulation in the kidneys might have been brought about by the persistence of the transverse fissures, which normally are present in the developing embryo, showing the primary centers of development of the kidneys. This is a transient fœtal condition development from which has been arrested.

The agencies that have caused the rapid growth of some parts on the one hand, and the arrested development of certain organs on the other, cannot be definitely determined. Causes of monstrosities have always been the capital problems of anatomy. Many investigators have been working on the phenomenon, using all means of experimentation, but never has a definite abnormality been produced by a definite experiment.

On the basis of modern theories of the causes of monsters and on many studies of several workers with regard to the origin of monsters, we may safely assume that the present case is not hereditary, as the sire's other offspring are normal. Both previous foals of the dam have also been normal. The foal immediately preceding the present one, however, had abnormal anterior limbs, but we are inclined to believe that the abnormality is not hereditary, as the offspring foaled by the same dam last December, which immediately followed the case under discussion, is normal. Some authorities claim that only very few extremity abnormalities, such as polydactylism, are hereditary. Nor can this abnormality be germinal, due to pathological ova or sperm, for, as other workers observed, if this were the case the changes in the embryo generally would be so pronounced that the embryo could not live through the duration of pregnancy but would be aborted in most cases. Otherwise the resulting offspring is a total monster, with complete and not localized disfiguration of most parts. We therefore assume that the present monster came from normal germs and normal fertilization. The normally fertilized egg, however, may not have been well surrounded by the mucous membrane of the uterus on its implantation, due, possibly, to poor health in the uterus during the preceding pregnancy and failure to return to normal before the succeeding pregnancy. The immediate effect of this faulty implantation is impaired nutrition, which according to some investigators, causes the fœtal membranes to greatly suffer, particularly the chorion. The amniotic fluid becomes deficient, the chorion rough and rugged, pressing on the developing embryo and

thus arresting development of certain parts. At the same time the chorion could not have grown *pari passu* with the growing long axis of the embryo, thus arresting the growth of the tail and producing the various abnormal curves of the vertebral column. The head was not affected, because, according to Williams,(15) the head grows first and faster than the caudal region. All these external abnormalities tend to show that a mechanical pressure occurred. Again, this faulty implantation altered the environment of the developing embryo, causing nutritional disturbance. Thus development in some of the organs was arrested or accelerated, resulting in the many aberrations of both the digestive and the urogenital systems.

As to the time when these agencies affected the normal developmental process, it is very likely that they occurred at about 4 to 7 weeks of development, as manifested by the presence of the limb buds which normally appear during the first 3 or 4 weeks of development. Prentiss et al.(10) mentioned that the cloaca usually appears after about one month, and should be completely separated into rectum and urogenital sinus in 36 to 40 days.

SUMMARY AND CONCLUSIONS

1. A multiple monstrosity of a full-term foal is reported.
2. The animal was not underdeveloped.
3. The following aberrations were observed: (*a*) Perobrachius. The left anterior limb was represented, besides the shoulder, by a winglike structure that on dissection revealed the presence of 4 bony segments. The shoulder had only a very small scapula. The right anterior limb was only the shoulder represented by a very small scapula. The muscles in the region of the arm on both sides were vaguely identified. (*b*) Atresia ani. (*c*) Agenesia of the tail. (*d*) The vertebral formula was only $C_7T_{18}L_6S_2Cy_0$. (*e*) Scoliosis and lordosis. The vertebral column viewed dorsally showed an undulating curve, and viewed laterally presented a marked concavity at the middle of the thoracic and lumbar vertebræ. (*f*) The right brachial plexus appeared incomplete, and only 5 out of the 11 branches were present. (*g*) Collateral branches of both brachial arteries were incomplete. There were present two large posterior mesenteric arteries, and the lateral and middle coccygeal arteries were wanting. (*h*) Persistence of the cloaca. Urethra and colon communicated freely with the phallic portion of the urogenital sinus. (*j*) Uterus didelphys. (*k*) Pseudohermaphrodismus femininus

externus. The internal genital organs were characteristically female, whereas the external genitals very much resembled the penis.

4. The most probable cause of this multiple monstrosity was faulty implantation with a subsequent disturbance in nutrition. This factor might have affected the normal process of development about the first or second month of development.

5. Because of the extremity deformities, which were the most conspicuous, the monster was classified as a perobrachius. It was a pseudohermaphrodismus femininus externus.

ACKNOWLEDGMENT

Thanks are due to Dr. Manuel D. Sumulong for correcting the manuscript, and to Dr. Sotero Macalalad for furnishing us data relative to the dam. To Mr. Juan A. Mariño, who donated the specimen to the College, we also extend our thanks.

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ILLUSTRATIONS

PLATE 1

FIG. 1. The foal, viewed from the left.
2. The foal, viewed from the right.

PLATE 2

FIG. 1. Bones of the left anterior limb.
2. Vertebral column and ribs.
3. The only bone (scapula) of the right anterior limb.

PLATE 3

The urogenital system. FIG. *1*, penislike structure; *2*, phallic portion of urogenital sinus; *3*, hymen; *4*, distal end of colon; *5*, rectum; *6*, dorsal cavity of uterovaginal canal; *7*, urinary bladder; *8* and *9*, ovaries; *10*, horn of uterus; *11*, broad ligament; *12*, ureter; *13*, right kidney; *14*, left adrenal; *15*, umbilical ligament; *16*, round ligament.

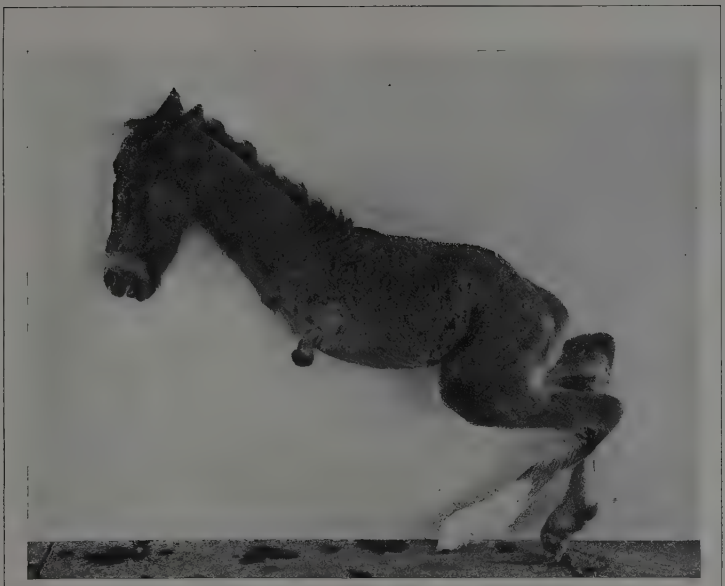

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PLATE 1.

PLATE 2.

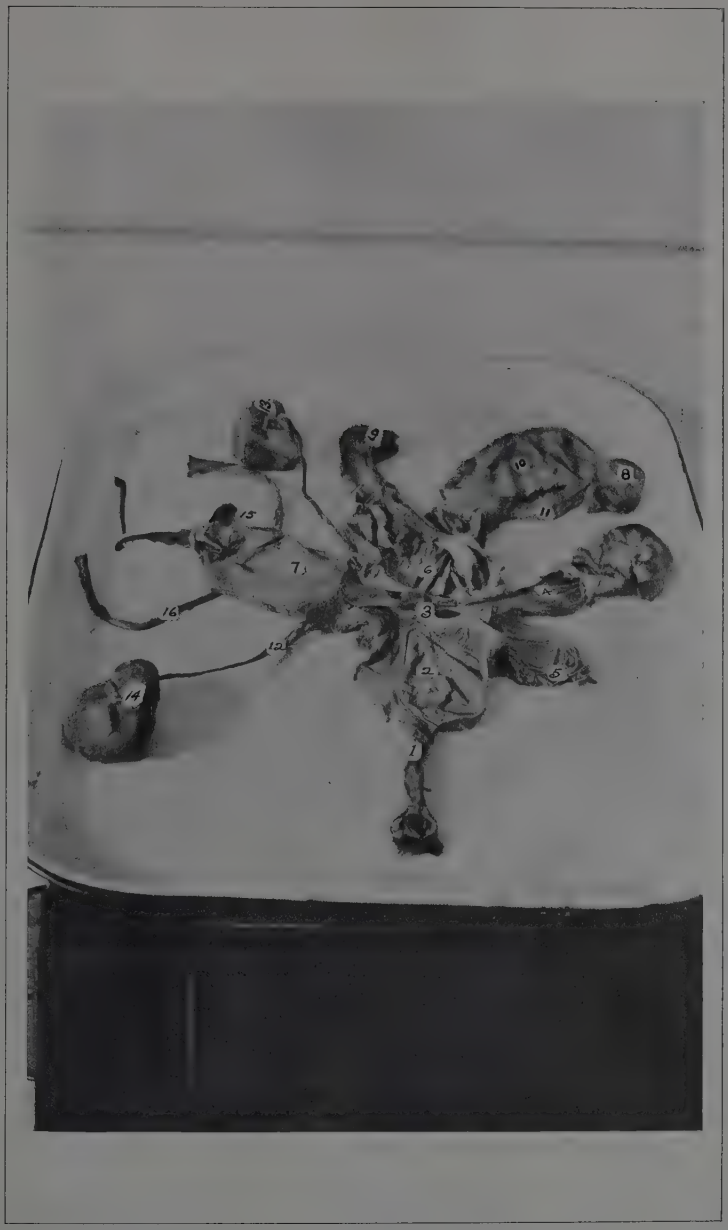

PLATE 3.

CHEMICAL STUDIES ON COCONUT PRODUCTS, III

A NEW PROCESS FOR THE EXTRACTION OF COCONUT OIL

By V. G. Lava, P. E. Torres, and S. Sanvictores

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ONE TEXT FIGURE

That the expeller process for extracting coconut oil is, from the point of view of the coconut industry, not an economical process in spite of its high degree of mechanization and efficiency, has been well appreciated for some time. In general the expeller process uses as its raw material copra which has passed through various stages of decomposition by the action of molds, bugs, and other organisms, and which has to be well dried before an efficient extraction can be made.

The use of copra as raw material has various effects:[1] (*a*) some oil, sugars and other carbohydrates, and proteins are lost during the period between the making of copra and the milling; (*b*) the oil produced contains a considerable amount of free fatty acids and is rancid, and therefore requires a refining process involving neutralization, decolorization, and deodorization, before it can be sold as edible oil; (*c*) the copra meal and cake are dirty and rancid and can be used only for animal feed and fertilizer, unless they are first purified by an expensive process; (*d*) no other by-products are obtainable that can be transformed into easily marketable products.

Since the first World War, when coconut oil was given a sudden boost, various investigators have realized these disadvantages to the coconut industry. Most investigations centered on the problem of improving the quality of copra. Some investigators, however, take a different view. Brill,[2] to mention only on worker, points out that a desirable way of obtaining coconut oil is by getting it directly from the fresh coconut meat, since drying difficulties are thus eliminated and the residual cake becomes available for food, and that the only drawback to this

[1] Lava, V. G. The Philip. Soc. Sci. Rev. (1) 11 (1939) 1–25; Philip. Nat. Res. Council Bull. No. 23 (1939) 95–100.

[2] Brill, H. C. Chem. and Met. Eng. 24 (1921) 567, 568.

method is the great difficulty of breaking the emulsion in the separation of the oil.

If the degree of extraction of the oil emulsion from the fresh coconut meat can be made high, and if the separation of the oil from the emulsion can be made almost complete, oil extraction directly from fresh meat offers many advantages. In the first place, the oil produced will be water white, will have no rancid odor and taste, and will have no appreciable free fatty acid. In most cases such an oil may be used directly as food, as is actually being done in many parts of the Philippines and in other Far Eastern countries; even if refining should be necessary, it can be accomplished by a simplified and short deodorization process. In the second place, the sugars and proteins, portions of which are extracted with the oil emulsion, can be used to good advantage, especially in view of the fact that the coconut meat has a peculiar pleasant flavor which is also partially extracted with the oil emulsion; a product known as "Coco-honey," which has now a good foreign market, is essentially composed of coconut sugars, protein, and oil to which sucrose has been added. In the third place, the coconut cake produced has still some food value, and may be used as a flour substitute; or, if the coconut meat is first pared before being subjected to extraction, as a low-grade desiccated coconut. In the fourth place, the loss of oil due to the action of copra bugs and to molding and to bacterial decomposition is prevented; in some cases this loss amounts to more than 10 per cent of the total oil from the fresh meat. In the fifth place, the coconut-shell by-products can be used not only to satisfy the power requirements of the plant, but also for other purposes (metallurgical charcoal, graphite, and the like).

Various methods have been proposed to extract the oil directly from the fresh coconut meat, among them those of Alexander,[3] Beckman,[4] and Lava.[5]

EXPERIMENTAL DATA

The present article gives data on various factors affecting the extraction of emulsion or gatâ from fresh coconut meat by cage hydraulic pressure, and also preliminary data on the efficiency of coconut oil recovery by the Lava process, together with

[3] Alexander, Wallace. U. S. 1,366,338 and U. S. 1,366,339 (1921).
[4] Beckman, J. W. British 326,195 (1928).
[5] Lava, V. G. U. S. 2,101,371 (1937).

data on the performance of the machinery used. Briefly this process consists in extracting the oil emulsion from the comminuted fresh meat by pressing, breaking this emulsion by regulating its pH or by further dehydration of the protein in the emulsion, and finally separating the oil by mechanical means.

In the experiments on the effect of various factors on the extraction of gatâ, fresh coconut meat, grated to about the size of sawdust, was used, and pressing was done in a 1-kilo capacity cage hydraulic press. (A. L. G. Dehne, German manufacture, with an area of about 122.5 square centimeters). The coconuts were bought in the Manila markets.

Table 1 shows the effect of pressure on the efficiency of extraction of oil from grated coconut meat.

Table 2 shows the effect of the amount of water used in the first pressing on the efficiency of extraction of oil from grated coconut meat.

Table 3 shows the effect of the amount of water used in the second and third pressings on the efficiency of extraction of oil from grated coconut meat.

Table 4 shows the effect of the temperature of water used on the efficiency of extraction in the first pressing of oil from grated coconut meat.

Table 5 shows the effect of the time of contact of the grated coconut meat with water on the efficiency of extraction in the first pressing.

Table 6 shows the effect of the pH of the water used on the efficiency of extraction in the first pressing of grated coconut meat.

Table 7 shows the effect of further grinding on the efficiency of oil extraction in the first pressing of grated coconut meat.

Tables 8 and 9 give data on the efficiency of oil recovery by the Lava process, involving the use of crude rollers for the extraction of the oil emulsion and small capacity Westphalia centrifuges for separating the oil. These data were obtained in a pilot plant in Calumpang, Laguna Province, beginning in August and ending November, 1937.

Table 8 gives data on the efficiency of oil extraction, on the quality of the nuts used, and on the quantity of some of the by-products obtained with the use of the process described.

TABLE 1.—*Effect of pressure on efficiency of extraction of oil from grated coconut meat.*

[Temperature of extraction, 28°C. Water added in first pressing, 50 per cent of fresh weight; in second pressing, 100 per cent of weight of cake from first pressing; in third pressing, 100 of weight of cake from second pressing.]

Experiment No.	Date.	Weight of fresh sample used.	Pressure.	After first pressing.					After second pressing.				
				Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Oil in cake (based on fresh sample).	Nonoil solids in cake (based on fresh sample).	Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Oil in cake (based on fresh sample).	Nonoil solids in cake (based on fresh sample).
	1939	*Kg.*	*Atmospheres.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 4	1,083	100	34.4	41.7	46.1	9.5	11.1	32.2	40.3	50.9	9.8	9.4
2	do	0.920	200	34.8	41.7	50.0	10.1	10.1	31.0	40.0	48.2	9.0	9.6
3	do	0.936	300	33.2	39.9	49.6	9.9	10.1	28.4	38.4	47.0	8.3	9.2
4	do	0.963	400	3.08	39.2	50.0	9.4	9.3	26.0	37.2	52.1	8.5	7.8
A	do	Fresh sample: Water (wet basis), 53.2 per cent; Oil (dry basis), 64.6 per cent; Oil (wet basis), 30.3 per cent; Nonoil solids (wet basis), 16.5 per cent; Nitrogen (dry oil-free basis), 3.67 per cent; Protein (dry oil-free basis), 21.2 per cent; Protein (dry but not oil-free basis), 7.5 per cent; Protein (wet basis), 3.5 per cent											
A[1]	do	Combined sapals after third pressing: Nitrogen (dry oil-free basis), average, 1.4 per cent; Protein (dry oil-free basis), average, 8.1 per cent; Protein (dry but not oil-free basis), average 1.23 per cent; Protein, based on fresh sample, average, 0.74 per cent											
5	August 7	0.950	500	29.0	38.8	55.8	9.8	7.9	23.7	37.4	47.6	7.1	7.7
6	do	0.858	600	26.8	36.9	58.7	9.9	7.0	20.9	34.9	46.9	6.4	7.2
B	do	Fresh sample: Water (wet basis), 51.8 per cent; Oil (dry basis), 64.1 per cent; Oil (wet basis), 30.8 per cent; Nonoil solids (wet basis), 17.4 per cent											

Experiment No.	Date.	After third pressing.					Efficiency of oil extraction.			Extraction of nonoil solids.		
		Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Oil in cake (based on fresh sample).	Nonoil solids in cake (based on fresh sample).	First pressing.	Second pressing.	Third pressing.	First pressing.	Second pressing.	Third pressing.
	1939	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 4	30.0	40.7	49.9	8.9	8.9	69	68	71	33	43	46
2	do	29.2	39.8	45.3	7.9	9.6	67	71	74	39	42	42
3	do	27.2	39.9	40.3	6.6	9.7	68	73	78	39	44	41
4	do	24.4	40.5	42.6	6.2	8.3	69	72	80	44	53	50
5	August 7	21.5	38.0	42.8	5.7	7.6	68	77	82	54	56	56
6	do	19.3	37.9	42.4	5.1	6.9	68	79	83	60	59	58

TABLE 2.—*Effect of amount of water used in first pressing on efficiency of extraction of oil from grated coconut meat.*

[Temperature of extraction, 24°C; pressure, 300 atmospheres.]

Experiment No.	Date.	Weight of fresh sample used.	Water used (based on fresh sample).	Cake after pressing (based on fresh sample).	Weight of gatâ extracted per kilogram of sample.	Weight of oil from gatâ by boiling and pressing.	Weight of pressed protein cake.	Water in protein cake (wet basis).	Oil in protein cake (dry basis).	Nonoil solids extracted (based on fresh sample).	Oil extracted (based on fresh sample).	Efficiency of oil extraction.	Extraction of nonoil solids.
	1939	*Kg.*	*Per cent.*	*Per cent.*	*Kg.*	*Kg.*	*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 21	0.912	0	42.5	0.525	.125	0.077	18.0	21.4	5.9	15.3	50	37
2	do	0.951	50	36.2	0.600	0.169	0.085	13.0	9.7	7.9	18.6	61	44
3	do	1.008	100	36.0	0.630	0.186	0.088	13.2	8.7	6.9	19.3	64	43
4	do	0.947	200	35.0	0.614	0.176	0.098	15.1	10.8	7.8	19.5	64	49
A	do	Fresh sample: Water (wet basis), 55.8 per cent Oil (dry basis), 65.8 per cent Oil (wet basis), 30.4 per cent Nonoil solids (wet basis), 15.8 per cent											

TABLE 3.—*Effect of amount of water used in second and third pressings on efficiency of extraction of oil from grated coconut meat.*

Experiment No.	Date.	Weight of fresh sample used.	First pressing.						Second pressing.					
			Water used (based on fresh sample).	Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Oil in cake (based on first sample).	Nonoil solids in cake (based on fresh sample).	Water used (based on cake fresh first pressing).	Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Oil in cake (based on fresh sample).	Nonoil solids in cake (based on fresh sample).
	1939	*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 17	1.031	50	34.9	41.4	57.5	11.7	8.8	100	30.3	41.5			
2	do	0.969	50	37.1	42.9	58.7	12.4	8.8	200	31.0	41.5	48.2	8.8	9.3
3	do	0.861	50	38.9	45.1	60.0	12.8	8.6	300	30.9	41.6	50.5	9.2	8.9
4	do	0.976	50	38.6	44.7	57.1	12.3	9.2	400	31.3	44.0	48.8	8.6	8.9
A	Do	Fresh sample: Water (wet basis), 51.3 per cent Oil (dry basis), 65.6 per cent Oil (wet basis), 31.8 per cent Nonoil solids (wet basis), 16.9 per cent												

Experiment No.	Date.	Third pressing.						Efficiency of oil extraction.			Extraction of nonoil solids.		
		Water used (based on cake in second pressing).	Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Oil in cake (based on fresh sample).	Nonoil solids in cake (based on fresh sample).	First pressing.	Second pressing.	Third pressing.	First pressing.	Second pressing.	Third pressing.
	1939	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 17	100	28.7	41.0	47.8	8.1	8.8	58	----------	75	48	----------	48
2	do	200	29.1	43.5	46.8	7.5	8.9	61	72	77	48	45	47
3	do	300	28.2	44.1	42.7	6.7	9.1	60	71	79	49	47	46
4	do	400	28.6	46.2	45.6	7.1	8.5	61	73	78	46	47	50

TABLE 4.—*Effect of temperature on the efficiency of oil extraction in first pressing of grated coconut meat.*

[Temperature of extraction, 28°C.; pressure, 300 atmospheres.]

[Water used in extraction, 50 per cent of weight of fresh meat; mixing time, 5 minutes; pressing time, 10 minutes.]

Experiment No.	Date.	Weight of fresh sample used.	Pressure.	Temperature of water used.	Temperature of mixture before pressing.	Cake after pressing (based on fresh sample).	Calculations from boiling and pressing.									Calculations from solvent extraction.		
							Weight of gatâ extracted per kilogram of fresh sample.	Weight of oil from gatâ by boiling and pressing.	Weight of pressed protein cake.	Water in protein cake (wet basis).	Oil in protein cake (dry basis).	Nonoil solids extracted (based on fresh sample).	Oil extracted (based on fresh sample.	Efficiency of oil extraction.	Degree of extraction of nonoil solids.	Water in sapal cake (wet basis).	Oil in sapal cake (dry basis).	Efficiency of oil extraction.
	1939	*Kg.*	*Atmospheres.*	°*C.*	*C.*	*Per cent.*	*Kg.*	*Kg.*	*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 24	0.935	300	28	28	39.5	0.518	0.159	0.075	18.4	8.1	6.0	17.5	56	40	39.0	56.2	57
2	do	0.954	300	34	31	38.8	0.600	0.168	0.074	12.7	11.4	6.0	18.4	59	40	46.2	56.3	63
3	do	0.981	300	56	38	37.7	0.606	0.173	0.072	12.7	7.2	5.9	18.2	58	39	42.3	57.6	60
4	do	0.937	300	77	46	37.3	0.605	0.170	0.074	10.5	6.1	6.6	18.6	60	43	39.8	43.8	68

A	do	Fresh sample: Water (wet basis), 52.6 per cent Oil (dry basis), 66 per cent Oil (wet basis), 31.2 per cent Nonoil solids (wet basis), 15.2 per cent																
5	August 28	0.936	440	34	32	33.4	0.617	0.178	0.085	21.0	11.8	6.1	19.4	58	40	37.3	56.0	58
6	do	0.971	440	56	38	31.0	0.627	0.191	0.091	15.5	13.1	6.9	20.7	62	45	37.6	51.9	64
7	do	0.970	440	77	42	33.8	0.590	0.081	0.081	18.4	6.3	6.4	20.0	60	42	41.7	61.0	58
8	do	0.960	440	28	28	34.6	0.617	0.200	0.080	18.4	6.9	6.4	21.3	64	42	-------	-------	-------
B	do	Fresh sample: Water (wet basis), 51 per cent Oil (dry basis), 68.2 per cent Oil (wet basis), 33.4 per cent Nonoil solids (wet basis), 15.2 per cent																

TABLE 5.—*Effect of the time of contact of grated coconut meat with water on efficiency of oil extraction.*

[Temperature of extraction, 28°C.; Pressure, 450 atmospheres; mixing time, 5 minutes.]

Experiment No.	Date.	Weight of fresh sample used.	First pressing.																
			Calculation from solvent extraction.									Calculation from boiling and pressing.							
			Amount of water used (based on fresh sample).	Time of contract between meat and water.	Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Nonoil solids extracted (based on fresh sample).	Oil extracted (based on fresh sample).	Efficiency of oil extraction.	Extraction of nonoil solids.	Weight of gata extracted per kilogram of fresh sample.	Weight of oil obtained from gata by boiling and pressing.	Weight of pressed protein cake.	Water in protein cake (wet basis).	Oil in protein cake (dry basis).	Nonoil solids extracted (based on fresh sample).	Oil extracted (based on fresh sample).	Efficiency of oil extraction.
	1939	*Kg.*	*Per cent.*	*Min.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Kg.*	*Kg.*	*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 31	0.987	100	3	34.0	40.3	52.8	7.2	21.7	67	43	0.662	0.191	0.091	14.7	15.2	6.7	20.5	63
2	do	0.943	100	38	33.7	39.3	49.3	6.5	22.3	69	39	0.648	0.194	0.074	19.0	7.6	5.9	21.2	66
3	do	0.921	100	72	33.7	39.3	49.7	6.6	22.2	69	39	0.648	0.184	0.069	14.6	6.6	6.0	20.4	63
4	do	0.991	100	298	30.2	37.1	48.6	7.2	23.1	71	43	0.620	0.194	0.070	16.0	10.7	5.4	20.2	63

A	do	Fresh sample: Water (wet basis), 50.8 per cent; Oil (dry basis), 66 per cent; Oil (wet basis), 32.4 per cent; Nonoil solids (wet basis), 16.8 per cent																	
5	September 8	0.955	97.5	[a] 3	34.0	38.2	------	------	------	------	------	0.670	0.213	0.074	19.8	11.3	5.6	23.0	69
6	do	0.905	119	[a] 60	38.4	37.5	56.9	5.7	19.8	60	36	0.597	0.183	0.043	21.0	6.3	3.6	20.4	61
7	do	0.946	104	[a] 60	33.4	39.1	55.3	7.0	21.2	64	44	0.630	0.186	0.072	19.3	7.0	5.7	20.1	60
8	do	0.983	198	[a] 210	33.5	38.8	60.7	8.0	21.0	63	50	0.640	0.201	0.076	23.2	7.9	5.4	21.0	63
B	do	Fresh sample: Water (wet basis), 50.5 per cent; Oil (dry basis), 67.6 per cent; Oil (wet basis), 33.4 per cent; Nonoil solids (wet basis), 16.1 per cent																	

TABLE 5.—*Effect of the time of contact of grated coconut meat with water of efficiency of all extraction.*—Continued

Experiment No.	Date.	Second pressing.															
		Calculations from solvent extraction.									Calculations from boiling and pressing.						
		Amount of water used (based on cake).	Time of contact between cake and water.	Second pressed cake (based on fresh sample).	Water in second pressed cake (wet basis).	Oil in second pressed cake (dry basis.)	Nonoil solids extracted (based on fresh sample).	Oil extracted (based on fresh sample).	Efficiency of oil extraction.	Extraction of non oil solids.	Weight of oil from cream by boiling and pressing.	Weight of pressed protein cake.	Water in protein cake (wet basis).	Oil in protein cake (dry basis).	Total nonoil solids extracted (based on fresh sample).	Total oil extracted (based on fresh sample).	Efficiency of oil extraction.
	1939	*Per cent.*	*Min.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	August 31	200	[b] 3	29.4	45.6	43.9	7.9	24.5	76	47	0.019	0.010			7.5	22.5	70
2	do	200	[c] 147	27.9	42.2	45.8	8.1	24.3	75	48	0.019	0.007	14.0	10.0	6.4	23.3	72
3	do	200	[d] 3	27.7	41.6	46.1	8.1	24.3	75	48	0.020	0.013			7.1	22.7	70
4	do	200	960	26.4	38.0	52.5	9.1	23.3	72	54	0.019	0.007			5.9	22.2	69

[a] Pressed 3 minutes after mixing.
[b] Pressed 60 minutes after mere addition of water.
[c] Pressed 60 minutes after addition of water and mixing.
[d] Pressed 210 minutes after addition of water and mixing.
[e] Cake was left overnight and mixed with water the next day.

TABLE 6.—*Effect of pH of extraction water on the efficiency of oil extraction from grated coconut meat.*

[Temperature of extraction, 28°C.; pressure, 450 atmospheres; time of mixing, 60 minutes.]

Experiment No.	Date.	Weight of fresh sample used.	Amount of water used.	Reagent added.		Calculations from solvent extraction.						
				Reagent.	Amount.	Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Nonoil solids in cake (based on fresh sample).	Oil in cake (based on fresh sample).	Efficiency of oil extraction.	Extraction of nonoil solids.
	1939	*Kg.*	*Kg.*		*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	September 14	0.979	0.952	HCe	2.5	37.8	38.6	60.5	9.2	14.0	53	47
2	do	1.005	0.989	None		35.0	42.9	58.5	8.3	11.7	61	53
3	do	1.004	0.993	N_1CO_3	2.5	32.0	43.2	56.1	8.0	10.2	66	54
4	do	0.974	0.971	do	7.5	26.4	40.4	44.2	8.7	7.0	76	50
A	do	Fresh sample: Water (wet basis), 52.9 per cent Oil (dry basis), 63 per cent Oil (wet basis), 29.6 per cent Nonoil solids (wet basis), 17.5 per cent										

5[a]	September 18	0.918	0.904	None		36.0	40.3	59.5	8.7	12.8	55	50
6[a]	do	0.960	0.942	do		35.0	34.4	58.3	9.6	13.3	53	45
7[a]	do	0.938	0.926	Na_2CO_3	0.5	35.2	40.1	59.3	8.5	12.5	56	51
8[a]	do	0.942	0.923	do	1.0	35.9	39.8	57.0	9.3	12.3	57	47
B		Fresh sample: Water (wet basis), 54.3 per cent Oil (dry basis), 62.7 per cent Oil (wet basis), 28.2 per cent Nonoil solids (wet basis), 17.5 per cent										

Experiment No.	Date.	Calculations from boiling and pressing.								
		Weight of gatâ extracted per kilogram of fresh sample.	Gatâ.	Weight of oil from gatâ by boiling and pressing.	Weight of pressed protein cake.	Water in protein cake (wet basis).	Oil in protein cake (dry basis).	Nonoil solids extracted (based on fresh sample).	Oil extracted (based on fresh sample).	Efficiency of oil extraction.
	1939	*Kg.*	*pH.*	*Kg.*	*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	September 14	0.704	5.4	0.133	0.074	13.1	12.1	5.7	14.4	49
2	do	0.648	6.1	0.172	0.090	13.2	10.6	7.0	18.0	61
3	do	0.674	8.1	0.189	0.099	8.7	9.8	8.1	19.8	68
4	do	0.700	9.6	0.190	0.093	6.6	4.2	8.6	20.0	68
5[a]	September 18	0.632	6.3	0.160	0.089	10.8				
6[a]	do	0.643	6.3	0.178	0.099	13.2				
7[a]	do	0.636	6.5	0.178	0.094	12.3				
8[a]	do	0.630	6.7	0.158	0.088	13.3				

[a] Pressure used, 100 atmospheres.

TABLE 7.—*Effect of further grinding on the efficiency of oil extraction from grated coconut meat.*

[Temperature of extraction, 28°C.; pressure, 450 atmospheres.]

Experiment No.	Date.	Weight of fresh sample used.	Treatment (grinding +, no grinding —).	Calculations from solvent extraction.							Calculations from boiling and pressing.							
				Amount of water used.	Cake (based on fresh sample).	Water in cake (wet basis).	Oil in cake (dry basis).	Nonoil solids in cake (based on fresh sample).	Oil in cake (based on fresh sample).	Efficiency of oil extraction.	Extraction of nonoil solids.	Weight of gatâ extracted per kilogram of fresh sample.	Weight of oil from gatâ by boiling and pressing.	Weight of pressed protein cake.	Water in protein cake (wet basis).	Oil in protein cake (dry basis).	Nonoil solids extracted (based on fresh sample).	Oil extracted (based on fresh sample).	Efficiency of oil extraction.
	1939	*Kg.*		*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Pre cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Kg.*	*Kg.*	*Kg.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	October 5	1.742	—	1.713	33.8	33.7	61.0	8.5	13.2	60	49	0.603	0.314	0.145	14.1	8.7	6.5	18.8	57
2	do	1.600	+	1.566	28.3	35.9	57.2	7.8	10.3	69	53	0.648	0.343	0.142	16.8	(8.7)	6.7	22.1	67
A	do	Fresh sample: Water (wet basis), 50.5 per cent; Oil (dry basis), 66.7 per cent; Oil (wet basis), 32.9 per cent; Nonoil solids (wet basis), 16.6 per cent																	

3	October 10	1.748	—	1.728	36.3	37.2	59.5	9.2	13.5	59	45	0.578	0.305	0.146	11.9	10.3	6.6	18.2	55
4	do	1.517	+	1.500	29.3	35.9	57.3	8.0	10.7	68	52	0.678	0.318	0.122	12.7	6.3	6.5	21.4	65
B	do	Fresh sample: Water (wet basis), 50.5 per cent Oil (dry basis), 66.7 per cent Oil (wet basis), 32.9 per cent Nonoil solids (wet basis), 16.6 per cent																	
5	October 17	2.232	—	2.207	37.0	37.8	60.7	9.1	13.9	58	46	0.600	0.380	0.203	11.1	15.0	6.8	18.3	56
6	do	2.202	+	2.177	31.1	34.5	56.8	8.8	11.5	65	48	0.680	0.457	0.204	13.6	11.2	7.5	21.2	65
C	do	Fresh sample: Water (wet basis), 50.1 per cent Oil (dry basis), 66.3 per cent Oil (wet basis), 33 per cent Nonoil solids (wet basis), 16.9 per cent																	

TABLE 8.—*Efficiency of coconut oil extraction by the Lava process, using crude rollers and nonsolid-ejecting centrifuges.*

Experiment No.	Date.	Nuts. Source.	Weight per 100.	Weight of meat per 1,000.	Actual yield of oil per 1,000.	Actual oil yield (based on weight of fresh meat).	Weight of total oil obtainable from 1,000 nuts.	Weight of wet, coarse protein solids per 1,000 nuts	Weight of wet, fine protein solids per 1,000 nuts	Weight of wet sapal per 1,000 nuts.	Water in sapal (wet basis).	Weight of oil in sapal from 1,000 nuts.	Unextracted oil in sapal (based on total obtainable).	Weight of dry, oil-free sapal per 1,000 nuts.	Dry, oil-free sapal (based on fresh meat).	Efficiency of oil recovery.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1939		*Kg.*	*Kg.*	*Kg.*	*Per cent.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Per cent.*	*Kg.*	*Per cent.*	*Kg.*	*Per cent.*	*Kg.*
14	August 4	Aguirre, Calumpang	80	380	98.0	25.5	103.1			158	67.3	(5.1)	(5.0)	46.9	12.3	95
15	August 5	Lilio	87	410	99.0	24.5	102.8				68.7	(3.8)	(3.7)			96
16	August 6	Aguirre	75	385	102.0	26.5										
17	August 9	Lapad		406	115.0	28.4										
18	August 10	do	86	387	103.0	26.7	119.1			123		(16.1)	(13.5)			86
19	August 11	do	82	391	84.0	24.2	112.7			124		(18.7)	(16.5)			83
20	August 12	do	82	381	103.0	27.4	115.6					(12.6)	(10.8)			89
21	August 17	Cabubuhayan,	76	346	84.5	24.6		5.4	3.7	103						
22	August 18	Cabubuhayan, Aguirre	81	361	90.0	25.0				109						
23	August 19	do	78	351	88.0	25.0	101.0	4.7	3.5	109	54.3	13.0	13.0	37	10.6	87
24	August 20	Aguirre, Bautista	83	374	95.0	25.5	112.0	5.5	2.7	107	44.8	17.0	15.2	42	11.2	85
25	August 23	Bautista	83	378	106.2	28.4	123.0	5.6	3.2	118						87
26	August 24	do	81	370	96.5	26.4		9.8	4.0	129						
27	August 25	do	83	379	99.0	26.0		5.8	3.8	124						
28	August 26	do	83	368	96.0	26.0	123.0	5.4	3.8	138	55.2	27.0	21.9	35	9.5	78
29	August 27	do	82	371	96.2	25.8	123.4	5.4	3.4	147	55.7	27.2	21.9	38	10.2	78
30	August 30	do	80	371	94.5	25.4		5.2	4.0	135						
31	August 31	Loma	79	363	86.2	23.8		4.2	2.8	145						
32	September 1	do	81	361	90.0	24.9		4.4	3.4	152						

TABLE 8.—*Efficiency of coconut oil extraction by the Lava process, using crude rollers and nonsolid-ejecting centrifuges*—Cont.

Experiment No.	Date.	Nuts. Source.	Weight per 100.	Weight of meat per 1,000.	Actual yield of oil per 1,000.	Actual oil yield (based on weight of fresh meat).	Weight of total oil obtainable from 1,000 nuts.	Weight of wet, coarse protein solids per 1,000 nuts.	Weight of wet, fine protein solids per 1,000 nuts.	Weight of wet sapal per 1,000 nuts.	Water in sapal (wet basis).	Weight of oil in sapal from 1,000 nuts.	Unextracted oil in sapal (based on total obtainable).	Weight of dry, oil-free sapal per 1,000 nuts.	Dry, oil-free sapal (based on fresh meat).	Efficiency of oil recovery.
1	2	3	4		6	7	8	9	10	11	12	13	14	14	16	17
33	September 2	Loma	76	332	82.0	25.0	105.0	4.5	3.0	122	58.6	20.0	20.0	30	9.1	78
34	September 3	do	76	342	84.0	24.5	108.7	4.8	3.1	125	52.4	24.7	22.6	35	10.2	77
35	September 6	Dita, Bautista	83	340	96.0	28.1	------	4.6	3.4	125	------	------	------	------	------	------
36	September 7	Bautista	83	350	96.0	27.6	115.9	3.8	2.0	119	52.0	19.9	17.1	37	10.5	83
37	September 8	Bautista (ripe)	83	340	96.0	28.1	120.0	4.6	3.8	120	46.5	24.0	20.0	40	11.7	80
38	September 9	Mercado (picked green)	81	345	86.0	25.0	------	4.4	3.8	116	------	------	------	------	------	------
39	September 10	do	79	340	85.5	25.2	106.8	4.4	2.8	115	57.2	21.3	20.0	28	8.5	80
40	September 15	do	76	326	87.0	26.5	101.3	4.5	1.5	107	53.0	15.4	15.2	35	10.7	85
41	September 16	do	76	326	87.0	26.8	105.3	3.8	2.0	99	49.3	18.3	17.4	32	9.8	83
42	September 17	Mercado, Fernandez	75	325	90.5	27.9	105.6	3.6	2.25	99	55.6	15.1	14.2	29	8.9	86
43	September 20	Fernandez, Noma	83	365	94.0	25.6	111.1	4.9	1.8	104	45.0	17.1	15.3	40	10.9	85
44	September 21	do	81	356	93.0	26.2	107.2	4.8	2.2	103	50.5	14.2	13.2	36	10.1	87
45	September 22	do	81	351	94.0	26.6	110.7	4.6	2.0	103	47.9	16.7	15.0	37	11.7	85
46	September 23	Villanueva (Sibulan)	81	356	93.5	26.1	112.1	5.3	2.8	104	43.5	18.6	16.6	40	11.2	83
47	September 24	do	82	370	96.0	26.0	109.8	5.2	3.2	99	47.5	13.8	12.5	38	10.3	88
48	September 25	do	80	361	93.0	26.1	105.0	5.3	2.3	97	------	(12.0)	(11.4)	------	------	89
49	September 26	do	79	360	95.2	26.4	111.0	4.4	2.8	96	44.0	15.8	14.2	38	10.5	86
50	September 29	Roberto Orlandes	88	370	103.8	28.0	120.4	5.0	2.8	99	------	16.6	(13.8)	------	------	86
51	September 30	S. Fernandez (old nuts)	88	381	98.4	25.8	111.3	4.6	3.0	102	43.0	12.9	11.6	45	11.8	88
52	October 1	do	80	355	95.0	26.8	108.4	4.4	2.8	91	43.0	13.4	12.4	38	10.7	88

53	October 2	P. Toscara	82	366	97.0	26.1	109.0	4.6	3.6	105	47.0	12.0	11.0	44	12.0	89
54	October 5	Aniquinta	80	362	98.8	27.1	112.6	4.6	3.2	102	46.4	13.8	12.2	41	11.3	88
55	October 6	do	82	356	97.4	27.4	112.5	6.8	2.8	100	45.2	15.1	13.3	40	11.2	87
56	October 7	do	83	366	97.5	26.6	------	5.0	2.8	100	------	------	------	------	------	------
57	October 8	Mercado	77	333	92.4	27.9	105.8	4.8	3.0	98	------	(13.4)	(12.6)	------	------	87
58	October 11	do	76	329	88.4	26.8	101.8	3.2	2.8	97	47.0	13.6	13.3	38	11.5	87
59	October 12	Suelam	72	311	88.0	28.3	97.5	5.2	2.6	90	53.1	9.5	9.7	33	10.6	90
60	October 13	Chiquito	84	349	93.0	26.7	101.8	4.6	3.4	99	55.5	8.8	8.6	35	10.0	91
61	October 14	do	83	358	90.0	25.2	101.0	5.2	3.2	97	44.8	11.0	10.9	42	11.7	89
62	October 15	do	80	348	92.0	26.5	104.4	4.4	3.4	90	47.2	12.1	11.6	35	10.0	88
63	October 18	do	78	344	87.2	25.2	103.0	4.8	2.6	93	------	(15.8)	(15.3)	------	------	85
64	October 19	do	74	339	87.2	25.2	102.2	4.6	3.4	98	------	(15.0)	(14.7)	------	------	85
65	October 20	do	75	330	89.0	27.0	100.1	5.2	2.8	98	------	(11.1)	(11.1)	------	------	89
66	October 21	do	77	340	92.6	27.3	103.4	5.6	4.2	113	------	(10.8)	(10.4)	------	------	90
67	October 22	do	75	334	93.0	27.8	102.4	8.2	3.8	106	------	(9.4)	(9.2)	------	------	91
68	October 25	Chiquito (ripe)	80	344	94.8	27.6	107.8	7.8	3.2	107	------	(13.0)	(12.0)	------	------	88
69	October 26	do	80	339	90.8	26.7	102.6	6.0	2.8	106	------	(11.8)	(11.5)	------	------	88
70	October 27	do	79	335	91.0	27.2	104.2	7.2	3.2	104	------	(13.2)	(12.7)	------	------	87
71	October 28	do	79	341	93.0	27.1	106.4	7.4	3.4	110	------	(13.4)	(12.6)	------	------	87
72	October 29	do	79	346	89.0	25.8	98.2	6.4	3.8	87	44.7	9.2	9.4	39	11.2	91
73	November 1	Chiquito, Anong	81	349	99.2	28.3	106.4	8.4	3.2	89	------	(7.2)	6.8	------	------	93
74	November 2	do	81	353	92.5	26.1	106.9	6.8	4.5	101	45.6	14.4	13.4	41	11.6	87
75	November 3	do	81	369	90.5	24.5	------	5.4	10.1	103	------	------	------	------	------	------
76	November 4	do	82	359	96.0	26.8	------	6.2	3.4	87	47.8	12.9	------	33	------	------
77	November 5	do	81	347	94.0	27.1	------	7.0	3.6	84	------	------	------	------	------	------
78	November 8	do	79	343	90.0	26.1	------	7.0	5.2	89	------	------	------	------	------	------
		Average	80	355	93.6	26.7	108.1	5.5	3.2	106	50.2	14.6	13.4	37	10.7	86

Average total obtainable oil based on fresh meat, 30.5 per cent.

TABLE 9.—*Some data on the use of crude rollers and Westphalia centrifuge for the Lava process.*

Experiment No.	Date.	Actual number of nuts used.	Temperature of water used.	Pressure on rollers (empirical).	Volume of first extract, per 1,000 nuts.	Period of first extraction per 1,000 nuts.	Period of centrifuge of first extract, per 1,000 nuts.	Volume of centrifuged first extract, per 1,000 nuts.	Volume of 2d and 3d extracts, per 1,000 nuts.	Period of 2d and 3d extraction, per 1,000 nuts.	Period of centrifuge of 2d and 3d extracts, per 1,000 nuts.	Total volume of cream per 1,000 nuts.	Total volume cream is made up to before treatment, per 1,000 nuts.	Period of centrifuge of treated cream, per 1,000 nuts.	Efficiency of oil recovery.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	1937		°C.		*Liters.*	*Min.*	*Min.*	*Min.*	*Liters.*	*Min.*	*Min.*	*Liters.*	*Liters.*	*Min.*	*Per cent.*
1	July 14	150	40–60		800	100			1850	234					
2	July 15	150	40–60		930	100			1070	200				600	
3	July 16	150	60–95		600				930						
4	July 20	150	56–95		530				1000		400				
5	July 21	150	63		600	100			670	234	400			700	
6	July 22	150	60		530	100			670	300	400			800	
7	July 23	150	40		530	100			730	200	600				
8	July 27	150	80		670	67			670	267	233			700	
9	July 28	150	80		530	80			530	287	267			600	
10	July 29	150	80	69/71/73	470	80			730	267	367			800	
11	July 30	150	80	71/73/73	730	87			730	267	267			700	
12	August 2	150	80	71/75/77	470	113			830	300	680			1200	
13	August 3	150	80	71/77/79	670	140			1000	307	680			1200	
14	August 4	150	70	71/79/81	730	107			800	367	800			920	95
15	August 5	150	80	71/77/79	770	133			800	467	1000			1400	96
16	August 6	150	80	71/77/79	570	200			500	307	400			2400	
17	August 9	200	80	71/77/79	600	170				360	400			1080	
18	August 10	300	80	71/77/79	500	117				254	234			2030	86
19	August 11	300	80	71/77/79	450	110	117	100		270	140	150	333	1780	83
20	August 12	300	80	71/77/79	430	94	87	117		267	190	200	400	600	89
21	August 17	300	80	71/77/79	370	127	100	100		294	140	150	333	600	
22	August 18	300	80	71/77/79	400	87	100	100		234	234	133	333	650	

23	August 19	400	80	71/77/81	425	[illegible]	125	88	--------	260	300	163	300	525	87
24	August 20	400	100	71/77/79	425	118	150	100	--------	268	226	162	300	465	85
25	August 23	500	80	71/77/79	--------	100	--------	110	--------	230	--------	180	280	540	87
26	August 24	500	80	71/77/79	--------	108	80	90	--------	198	180	160	280	600	--------
27	August 25	500	80–60	71/77/79	--------	[illegible]	92	100	--------	166	308	160	280	600	--------
28	August 26	500	80–60	71/77/79	--------	64	80	90	--------	126	126	170	280	480	78
29	August 27	500	80–60	73/79/81	--------	80	58	100	--------	136	120	180	280	420	78
30	August 30	600	60	73/79/81	--------	[illegible]	80	97	--------	293	182	200	234	400	--------
31	August 31	600	60	73/79/81	--------	70	59	92	--------	130	94	183	234	300	--------
32	September 1	700	60	73/79/81	--------	63	57	93	--------	156	143	173	200	430	--------
33	September 2	700	60	73/79/81	--------	67	64	88	--------	188	140	173	200	340	78
34	September 3	700	60	73/81/83	--------	71	57	89	--------	185	91	157	200	360	77
35	September 6	800	60	73/83/83	--------	[illegible]	52	94	--------	266	121	162	187	300	--------
36	September 7	800	80	75/81/83	--------	100	54	100	--------	177	113	162	200	300	83
37	September 8	800	80	75/83/85	--------	80	65	100	--------	202	137	187	200	280	80
38	September 9	800	80	{75/81/83, 71/81/83}	--------	[illegible]	62	91	--------	100	137	200	212	280	(b)
39	September 10	800	80	75/81/83	--------	35	59	87	--------	--------	--------	200	212	--------	[b] 80
40	September 15	800	80	{71/77/79, 75/83/85}	--------	[illegible]	49	79	--------	128	123	167	187	280	[b] 85
41	September 16	800	80	75/83/85	--------	[illegible]	50	75	--------	121	141	160	187	270	[b] 83
42	September 17	800	80	75/83/85	--------	34	56	87	--------	130	119	175	187	280	[b] 86
43	September 20	800	80	75/83/85	--------	31	56	87	--------	128	137	173	187	310	[b] 85
44	September 21	800	80–90	75/83/85	--------	32	35	75	--------	135	113	163	187	250	[b] 87
45	September 22	800	80–90	75/83/85	--------	30	44	77	--------	131	89	168	187	290	[b] 85
46	September 23	800	80–90	{71/77/79, 75/83/85}	--------	29	56	77	89	264	136	163	182	275	[b] 83
47	September 24	500	80–90	75/83/85	--------	72	44	76	84	314	140	180	200	216	[a] 88
48	September 25	600	80–90	{71/79/81, 75/83/85}	--------	40	70	100	100	444	140	200	240	400	[b] 89
49	September 26	500	80–90	73/83/85	--------	174	120	124	80	[illegible]04	180	204	240	280	[d] 86
50	September 29	500	80–90	77/83/85	--------	128	140	140	60	206	102	200	240	290	[d] 86
51	September 30	500	80–90	75/83/85	--------	144	136	140	60	296	104	200	240	280	[d] 88
52	October 1	500	80–90	75/83/85	--------	122	130	124	56	270	148	180	220	300	[d] 88
53	October 2	500	80–90	73/83/85	--------	184	140	140	80	380	114	200	240	360	[d] 89
54	October 5	500	80–90	75/83/85	--------	50	110	150	--------	278	134	220	240	360	[d] 88
55	October 6	500	80–90	75/83/85	--------	76	134	[illegible]	66	340	178	160	200	360	[d] 87
56	October 7	500	80–90	75/83/85	--------	158	160	144	76	350	177	220	260	260	(d)
57	October 8	500	80–90	75/83/85	--------	128	144	120	60	282	120	180	220	260	[d] 87

TABLE 9.—*Some data on the use of crude rollers and Westphalia centrifuge for the Lava process*—Continued.

Experiment No.	Date.	Actual number of nuts used.	Temperature of water used.	Pressure on rollers (empirical).	Volume of first extract, per 1,000 nuts.	Period of first extraction per 1,000 nuts.	Period of centrifuged of first extract, per 1,000 nuts.	Volume of centrifuge first extract, per 1,000 nuts.	Volume of 2d and 3d extract, per 1,000 nuts.	Period of 2d and 3d extraction, per 1,000 nuts.	Period of centrifuge of 2d and 3d extracts, per 1,000 nuts.	Total volume of cream per 1,000 nuts.	Total volume cream is made up to before treatment, per 1,000 nuts.	Period of centrifuge of treated cream, per 1,000 nuts.	Efficiency of oil recovery.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
56	October 11	500	80–90	75/83/85	-------	134	104	120	60	230	130	180	220	300	[d] 87
57	October 12	500	60	75/83/85	-------	144	122	120	46	226	114	166	200	240	[d] 90
60	October 13	500	60	75/83/85	-------	154	140	122	58	298	86	180	220	240	[d] 91
61	October 14	500	60	75/83/85	-------	150	90	126	54	256	114	180	220	260	[d] 89
62	October 15	500	80–90	75/83/85	-------	136	136	120	70	236	150	190	220	240	[d] 88
63	October 18	500	80–90	75/83/85	-------	104	112	124	52	208	108	180	220	240	[d] 85
64	October 19	500	80–90	75/83/85	-------	144	140	120	80	330	180	180	220	240	[d] 85
65	October 20	500	80–90	75/83/85	-------	144	138	120	60	348	111	180	220	240	[d] 89
66	October 21	500	80–90	75/83/84	-------	78	80	90	100	392	104	190	220	280	[c] 90
67	October 22	500	80	75/83/85	-------	86	70	84	86	556	136	170	200	180	[c] 91
68	October 25	500	80	75/83/85	-------	74	80	90	110	326	140	200	210	240	[c] 88
69	October 26	500	80	75/83/85	-------	62	74	80	90	402	100	190	200	240	[c] 88
70	October 27	500	80	75/83/85	-------	60	54	78	102	366	120	180	220	280	[c] 87
71	October 28	500	80	75/83/85	-------	60	48	78	112	332	88	190	200	260	[c] 87
72	October 29	500	80	75/79/81	-------	72	48	76	88	354	92	160	200	240	[c] 91
73	November 1	500	80	75/83/85	-------	80	50	80	94	416	120	174	200	240	[c] 93
74	November 2	800	80	71/79/81 75/83/85	-------	32	40	72	94	187	80	166	198	250	[b] 87
75	November 3	800	80	75/83/85	-------	30	38	72	-------	-------	-------	-------	225	-------	(b)
76	November 4	500	80	75/83/85	-------	72	38	80	110	326	134	190	230	240	(a)
77	November 5	500	80	75/83/85	-------	63	44	80	110	292	84	190	230	240	(a)
78	November 8	500	80	75/83/85	-------	112	32	72	94	388	110	190	230	240	(a)

[a] 1 pair of rollers used. [b] 2 pairs of rollers used. [c] 3 extractions, 1 pair of rollers. [d] 4 extractions, 1 pair of rollers.

Table 9 gives data on the performance of the crude rollers used for pressing the emulsion from either the coarsely ground or shredded meat, and on the performance of three small Westphalia centrifugal separators (Type OA 800, with a capacity each of 350 liters per hour) in the separation of the oil, solids, and water.

DISCUSSION OF RESULTS

Tables 1 to 7 show that cage hydraulic pressure alone, even when the coconut meat is grated and even further ground, cannot be expected to effect a very high extraction of oil. While errors in manipulation are to be noted in these tables, as shown by lack of checks in some cases, these errors are small compared with actual extractions.

From Table 1 it may be concluded that while pressure has no appreciable effect on the extraction of oil in the first pressing, it has some effect on the extraction in the successive pressings. Meat pressed at 100 atmospheres per square inch in the first pressing yields about the same amount of oil as meat pressed at 600 atmospheres, while meat pressed at 100 atmospheres in the third pressing yields a smaller amount of oil than meat pressed at 600 atmospheres. Table 1 also shows that pressure has some effect on the extraction of nonoil solids (sugars and proteins), and that the lower the pressure used, the greater the difference between nonoil solids extracted in the first and third pressings. While at 100 atmospheres 69 per cent of the total obtainable oil and around 33 per cent of the total nonoil solids are extracted in the first pressing, and 71 per cent of the total oil and around 46 per cent of the total solids in the third pressing, at the higher pressure of 600 atmospheres, 68 per cent of the total oil and around 60 per cent of the total solids are extracted in the first pressing, and 83 per cent of the total oil and around 60 per cent of the total solids in the third pressing.

The percentages of water, oil, and nonoil solids in Table 1 are significant; in fact, results of analyses shown in Tables 1 to 7 show that the average water content of fresh meat is 51.8 per cent, the average oil content is 31.6 per cent, and the average content of nonoil solids is 16.6 per cent. Table 1 also shows that the protein content (N $\times$ 5.8) of the fresh meat is around 3.5 per cent, and that while only around 0.74 per cent is left in the cake after the third pressing, this quantity is equivalent to 8.1 per cent in the dry, oil-free cake. This percentage of protein in the pressed coconut cake is still higher than those found in many cereals.

In Table 2 is shown the effect of the amount of water mixed with the meat before first pressing on the efficiency of extraction. Here, however, instead of determining the amounts of extracted oil and solids by the usual method of determining the percentages of water, oil and solids in both the fresh sample and the cake, the extracted oil emulsion was boiled to almost complete dehydration of the proteins, and the remaining mixture was pressed to produce the protein cake; the extracted oil was calculated from the actual amount of the oil separated out and the oil (determined also by solvent extraction) in the pressed protein cake, and the total extracted solids were calculated from the pressed protein cake after drying and solvent extraction.

Table 2 also shows that the efficiencies of oil extraction and of the extraction of nonoil solids do not vary much from those recorded in Table 1, and that the addition of from 50 to 200 per cent of water (based on the fresh meat) does not change the efficiency of extraction. Exception must be made in the case where no water is added at all; in this case the oil extraction seems to be definitely less than when water is added; and even the weight of the emulsion obtained per kilogram of fresh meat is less.

Table 3, giving the effect of the amount of water mixed with the cakes in the second and third pressings, shows that an increase in water for mixing has no appreciable effect on the efficiencies of oil and nonoil solids extraction.

Table 4 shows that changes in the temperature of the mixture of water and fresh meat before pressing (between 28° C. and 46° C.) have hardly any effect on the efficiencies of extraction of oil and nonoil solids. Only when the temperature goes below the solidification point of coconut oil (around 21° C.) can the effect of temperature be expected to be appreciable.

Even the time of contact between the water and the fresh meat before pressing does not seem to have any appreciable effect on the efficiencies of extraction of oil and nonoil solids as is shown Table 5.

The effect of the pH of the water used with the fresh meat on the efficiency of extraction is shown in Table 6, which indicates that while a low pH of water decreases the efficiency of oil extraction, a high pH increases the efficiency of extraction of the oil; in the case of the nonoil solids, no appreciable effect is noted with change of pH of the water. In any case, the effect of a change in the pH of the emulsion to 9.6 does not seem to increase the efficiency of oil extraction to more than 76 per

cent; furthermore, it is doubtful whether the addition of an alkali to the fresh meat will not change the quality of the oil and its by-products.

Again, Table 7 shows that grinding after grating increases the efficiencies of oil extraction and of the extraction of nonoil solids by about 10 per cent.

From Tables 1 to 7 it must be concluded that while the factors of cage hydraulic pressure, temperature, further grinding, the amount of water mixed with the grated fresh coconut meat, and the pH of the water, play some rôle in the extraction of oil and nonoil solids from the meat, under no circumstances within the limits of the above experiments was the efficiency of oil extraction increased to over 70 per cent in the first pressing and to over 83 per cent in the third pressing by any of these factors.

The use of rollers for extraction, however, has better possibilities. Table 8 shows the results of extraction with mild steel rollers, 28 inches long and 10 inches in diameter. These rollers are placed one on top of the other, have rough surfaces, and have a speed of 8 to 16 R. P. M. The comminuted meat is fed to the rollers on one side by means of a moving plate actuated by a cam. Water is allowed to trickle on the meat before it passes between the rollers. After the first pressing the cake collected on the other side of the rollers is again placed on the moving plate for second and third pressings; in both cases water is allowed to trickle on the cake before pressing. The amount of total oil obtainable from each lot of fresh meat, and of the oil left in the cake, were determined by the usual method of getting samples, drying them, and extracting the oil with a solvent. The actual yield of oil in each lot was found by weighing the dry oil separated by the centrifuge, after treatment of the emulsion according to the process described. In those cases where the total obtainable oil and the actual oil yield are the only data taken in the experiment, the oil in the cake was calculated from the difference in the two oil determinations. Such values are given in parenthesis in columns 13 and 14 of Table 8. In almost all cases the difference between the amount of oil in the sapal determined by solvent extraction and that calculated from the oil in the original fresh meat and the oil yield, was not more than 1 kilogram per 1,000 nuts.

Table 8 shows that with the use of rollers and with three pressings, the lowest efficiency of oil recovery obtained is 77 per cent and the highest is 96 per cent, the average efficiency of all the runs being 86 per cent. In more concrete terms, 1,000 nuts

weighing 800 kilograms (husked),[6] and containing 355 kilograms of fresh unpared meat and 108.1 kilograms of total obtainable oil, yield with our crude unmechanized rollers and with small-capacity Westphalia centrifuges, 93.6 kilograms of white, non-rancid, acid-free oil. Furthermore, from the same 1,000 nuts, 106 kilograms of wet coconut cake, of which 53.2 kilograms (that is, 50.2 per cent of the cake) are water, 14.6 kilograms are oil, and 37 kilograms are dry, oil-free solids (mostly carbohydrates and protein), and 8.7 kilograms of wet protein cake with some oil, are obtained as by-products. The aqueous solution separated from the different extractions, which contain plenty of soluble sugars, are not considered in this series of experiments, although it has been well established by us that good alcohol and vinegar can be prepared from this solution, and that this aqueous extract may well be used with the protein cake in the preparation of "Cocohoney."

Or again, expressed in another way, of the total obtainable oil, which is 30.5 per cent of the fresh meat, the actual yield of oil by the new process, involving the use of crude rollers and small-scale centrifuges, is 86 per cent, which is equivalent to 26.7 per cent of the fresh unpared meat; and the dry, oil-free solids obtained as residue is 10.7 per cent of the fresh unpared meat. The latter figure corresponds, within 1 to 2 per cent, to the values for dry, oil-free coconut cake given in Tables 1 to 7.

The performances of the rollers and the Westphalia centrifuges are described in Table 9. After the emulsion is extracted by use of the rollers, it is pumped into a tank from which it goes by gravity to a low-power centrifuge for the separation of the fine cellulosic materials and of some easily precipitated proteins. The cream obtained is then treated to precipitate the proteins, and after a few hours passed through a higher power separator for the separation of the oil.

Table 9 shows that the shortest time necessary with the rollers used in the first extraction of the emulsion from 1,000 nuts, is 50 minutes when one pair of rollers is used, and 29 minutes when two pairs of rollers are used. The time varies, depending on how well the feeding of the comminuted meat can be made, which is indicated by the fact that in the case of a good feed the cake, after passing through the rollers, comes out comparatively dry in the form of a uniform mat.

[6] This figure is rather low, and is due, probably, to the fact that many unripe coconuts, discarded by the desiccating factories, were used in the pilot plant.

With regard to the combined period of extraction in the second and third pressings, while the minimum period is 126 minutes for one pair of rollers and 100 minutes for two pairs of rollers, much longer periods are necessary in most of the experiments. Furthermore, no uniform mats of cake are found, and the cake is rather moist in some places. A close inspection of the rollers shows that they do not meet at all points, thus allowing the passage of the emulsion along with the outgoing cake. This contamination of the dry cake by the emulsion pressed out during the period of pressure in the roller surfaces accounts to some extent for the still high oil content of the coconut cake and for the total low average efficiency of oil recovery of around 86 per cent. It would appear from our observations that a few improvements could be made in the extraction of emulsion from coconut meat by means of rollers; such as (*a*) uniform rough surface of the rollers which should meet at all points; (*b*) a smaller number of revolutions of the rollers in conjunction with a larger diameter of the rollers; and (*c*) a better system of feeding of the comminuted meat to the rollers.

After passing through a low-power centrifuge, the minimum volume of cream obtained per 1000 nuts after the first extraction is 72 liters and the maximum is 150 liters, while the minimum combined volume of cream obtained after the third extraction is 133 liters and the maximum is 220 liters.

The poor performance of the Westphalia centrifuge used may easily be understood, considering that it is a nonsolid-ejecting small-capacity centrifuge with a maximum bowl speed of 5,800 R.P.M. There is now on the market a solid-ejecting centrifuge of high capacity with a speed of 6,400 R.P.M. However, even with the small-capacity Westphalia centrifuges used, the minimum period for centrifuging the first extracted emulsion from 1000 nuts is 35 minutes, and the maximum period is 160 minutes. The minimum period for centrifuging the combined extractions from the second and third pressings is 80 minutes and the maximum period is 1000 minutes, which was obtained at the beginning of our series of experiments, while the minimum period for centrifuging the total treated cream for oil separation is 180 minutes and the maximum period is 2400 minutes, which was also obtained at the beginning of our series of experiments.

COMMERCIAL POSSIBILITIES OF EXTRACTING OIL FROM FRESH COCONUT MEAT BY THE NEW PROCESS

The only way the commercial possibilities of extracting oil directly from fresh coconut meat may be evaluated is by com-

paring the cost of processing by any of the processes involving this concept (that is, the Lava process), with that by the copra-expeller process on low-grade copra.

Table 10 shows the cost of processing of coconut oil by the Lava process, not taking into consideration the commercial possibilities of the by-products. Table 10 shows the cost of factory and equipment for a production capacity of about 10 tons of oil a day involving 30,000,000 nuts a year, as well as the total cost per year of processing the coconuts to coconut oil; Table 11 shows the amount of oil obtainable per year, as affected by the efficiency of oil recovery (from 50 to 100 per cent) and taking into consideration the quality, specifically, the ripeness of the nuts and the regions from which they come; and Table 12 shows the cost of processing one kilo of coconut oil, as affected by the factors indicated in Table 11. The cost of processing shown in Table 12 is graphically shown in text fig. 1.

Table 12 and text fig. 1 show that the cost of processing of coconut oil per kilo is 0.0464 peso at 70 per cent efficiency of oil recovery, 0.0383 peso at 85 per cent efficiency, and 0.0342 peso at 95 per cent efficiency, when coconuts yield 108 kilograms of total obtainable oil per 1,000 nuts of 800 kilograms (husked); when coconuts yield 124 kilograms of total obtainable oil per 1,000 nuts of 800 kilograms, the cost of processing of coconut oil per kilo is 0.0406 peso at 70 per cent efficiency of oil recovery, 0.0333 peso at 85 per cent efficiency, and 0.0298 peso at 95 per cent efficiency. As coconuts differ in their oil contents, depending upon soil, climate, season, maturity, and other factors, for the purpose of the calculations, the average total obtainable oil in the overripe and semiripe nuts as they are actually picked for copra production may be assumed to be around 116 kilograms per 1,000 nuts of 800 kilograms (husked); with this average the cost of processing of coconut oil per kilogram is 0.0434 peso at 70 per cent efficiency of oil extraction, 0.0356 peso at 85 per cent efficiency, and 0.032 peso at 95 per cent efficiency.

Table 13 shows the cost of processing of coconut oil by the copra-expeller process, not taking into consideration the copra cake and meal by-products. This table shows that if we add up the cost of copraing of 0.50 peso per 1,000 nuts (the average in the Laguna towns is 0.80 peso), the cost of crude oil extraction of 0.015 peso per kilogram (about the average for a small expeller mill), and the cost of oil refining of 0.018 peso per kilogram (reported as the cost of partial refining in the Philippines), the total cost of processing of refined oil is 0.0402 peso

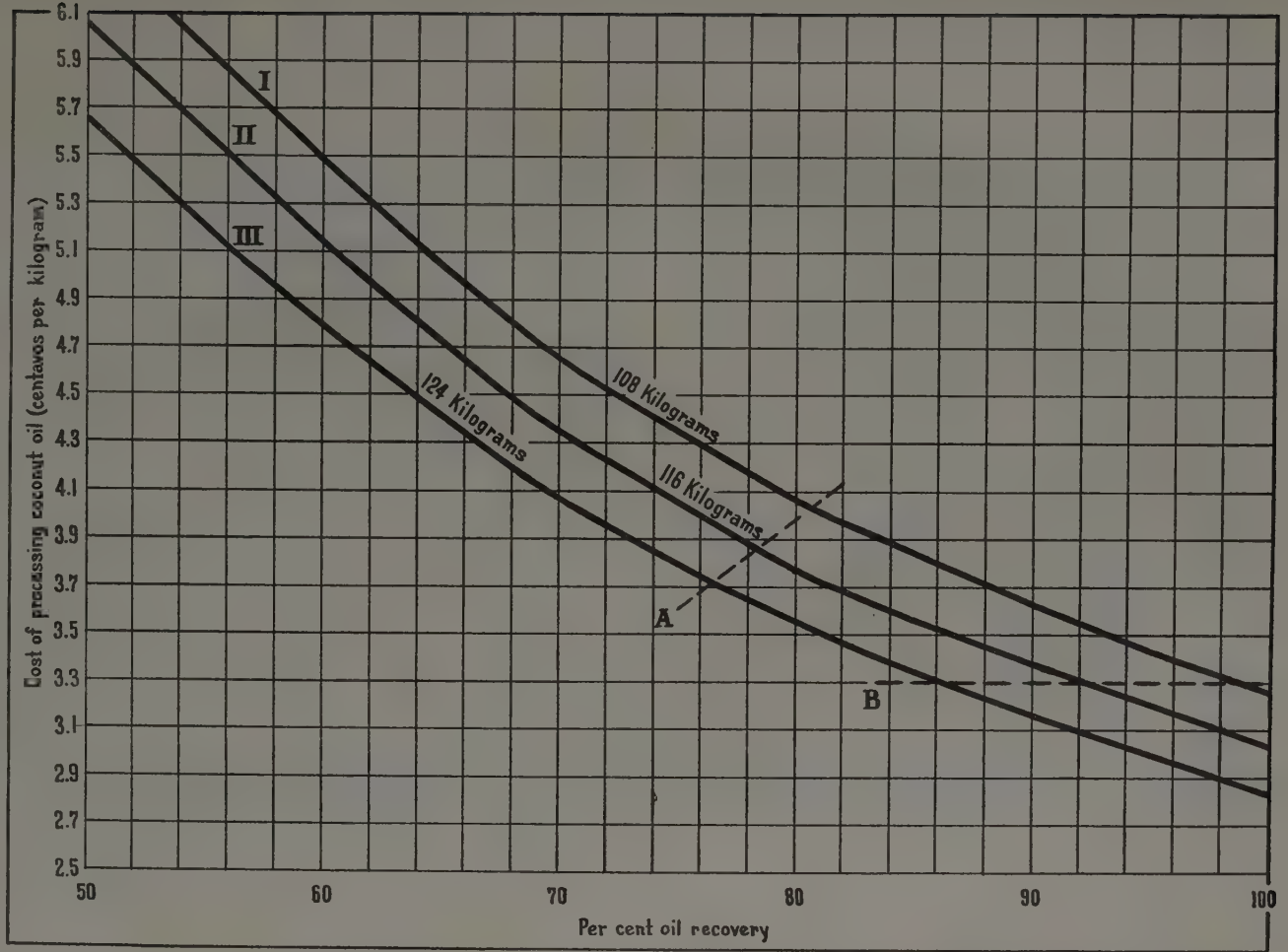

FIG. 1. Comparison of cost of processing coconut oil by the Lava process with that of the expeller process, not taking into consideration by-products. I, Lava process for nuts giving 108 kilograms total obtainable oil per 1,000; II, Lava process for nuts giving 116 kilograms total obtainable oil per 1,000; III, Lava process for nuts giving 124 kilograms total obtainable oil per 1,000; A, expeller process including manufacture of copra; B, expeller process not including manufacture of copra.

TABLE 10.—*Cost of processing coconut oil by the Lava process, disregarding by-products (plant capacity: 30,000,000 nuts per year of 300 days).*[a]

	Pesos
A. Cost of factory and equipment:	
Three grinders or shredders at 500 pesos each	1,500
Four pair of rollers, 36 inches long, 10 inches diameter, at 800 pesos each	3,200
Four pairs of rollers, 36 inches long, 15 inches diameter, at 1,800 pesos each	7,200
Four pairs of rollers, 36 inches long, 20 inches diameter, at 3,200 pesos each	12,800
Three rotojectors at 8,500 pesos each	25,500
Three driers, at 1,500 pesos each	4,500
One deodorizer, at 7,500 pesos each (complete)	7,500
One boiler, 80 H. P., with 100 to 125 pounds steam (complete)	4,500
One gass producer engineer, 250 H. P., with motor	45,000
Fifteen electric motors for rollers and centrifuges	5,600
Tanks	5,000
Wiring and switches	2,500
Conveyors	5,000
Piping	1,500
Land, building, and installation	25,000
Concrete foundation	3,000
Miscellaneous	10,700
Total	170,000
B. Total cost of processing per year:	
Shelling, at 1 peso per 1000 nuts	30,000
Labor, 30 men at 1 peso per day	9,000
Reserve for depreciation, 5 per cent of cost of factory and equipment	8,500
Repairs, at 5 per cent of cost of factory and equipment	8,500
Fuel and lubrication	2,000
1 plant manager, 6,000 pesos per year	6,000
1 chief chemist, 3,600 pesos per year	3,600
3 technicians, 1,200 pesos per year	3,600
1 chief engineer, 3,600 pesos per year	3,600
3 mechanics, 1,000 pesos per year	3,000
1 bookkeeper, 1,000 pesos per year	1,000
2 clerks, 480 pesos per year	960
3 extra laborers, 360 pesos per year	1,080
2 janitors, 300 pesos per year	600
Sales tax, 1.5 per cent gross earnings	10,000
Licenses, etc.	8,000
Transportation, chemicals, etc.	6,000
Total costs	105,440

[a] Cost based on 1938 prices.

per kilogram when the coconuts yield 108 kilograms of total obtainable oil per 1,000 nuts, 0.0386 peso per kilogram when the coconuts yield 116 kilograms of total obtainable oil per 1,000 nuts, and 0.0373 peso when the coconuts yield 124 kilograms of total obtainable oil per 1,000 nuts.

Since the millers do not pay for the cost of copraing, to them the cost of processing of refined (deodorized) coconut oil is only 0.033 peso.

TABLE 11.—*Total obtainable oil per year by the Lava process.*

[Per cent capacity, 30,000,000 nuts per year.]

Efficiency of oil recovery.	1,000 nuts yielding 108 kilograms oil (30.5 per cent).	1,000 nuts yielding 116 kilograms oil (32.6 per cent).	1,000 nuts yielding 124 kilograms oil (35 per cent).
Per cent.	*Tons.*	*Tons.*	*Tons.*
100	3,240	3,480	3,720
95	3,080	3,300	3,540
90	2,920	3,140	3,350
85	2,750	2,960	3,160
80	2,590	2,780	2,980
70	2,270	2,430	2,600
50	1,620	1,740	1,860

TABLE 12.—*Cost of processing of 1 kilogram of coconut oil by the Lava process.*

[Per cent capacity, 30,000,000 nuts per year.]

Efficiency of oil recovery.	1,000 nuts yielding 108 kilograms oil.	1,000 nuts yielding 116 kilograms oil.	1,000 nuts yielding 124 kilograms oil.
Per cent.	*Peso.*	*Peso.*	*Peso.*
100	0.0325	0.0303	0.0283
95	0.0342	0.0320	0.0298
90	0.0361	0.0336	0.0315
85	0.0383	0.0356	0.0333
80	0.0407	0.0376	0.0354
70	0.0464	0.0434	0.0406
50	0.0651	0.0606	0.0566

A comparison of the costs of processing oil by the new process and by the copra-expeller process is now possible. In text fig. 1 the points of intersection between the three curves (for nuts yielding 108 kilograms, 116 kilograms, and 124 kilograms, respectively, of total obtainable oil per 1,000 nuts) and line A shows at what efficiencies of oil recovery by the new process, from nuts of varying yields of total obtainable oil, this process may be considered commercially feasible. An efficiency, therefore, of oil recovery by the new process of 76 per cent for nuts giving 124 kilograms of total obtainable oil per 1,000 nuts, of 78 per cent for nuts giving 116 kilograms of oil per 1,000 nuts,

and of 81 per cent for nuts giving 108 kilograms of oil per 1,000 nuts, would be sufficient to compete with the expeller process, even when the advantages obtainable from the by-products are not taken into consideration.

Even assuming that the actual cost of copraing is zero (resulting from the possibility of coconut landlords imposing this condition on their tenants and sharecroppers), the average cost of processing of refined oil is 0.033 peso. This corresponds to 92 per cent necessary efficiency of oil recovery by the new process for nuts giving an average total obtainable oil of 116 kilograms per 1,000 nuts (intersection of line B and the three curves, text fig. 1), before commercialization is possible. This is certainly within the realm of possibility, although great care is already indicated as highly necessary in the selection of the nuts, so that only nuts matured for optimum oil content are taken.

Therefore, even when the advantages of the by-products of the new process over those of the copra-expeller process are not taken into consideration, the former process can compete commercially with the latter process, if the extraction of the emulsion from the fresh meat can be sufficiently mechanized and raised in efficiency. But this is not all; as was pointed out in the introduction to this article, direct extraction from the fresh coconut meat allows the utilization of the coconut cake, the coconut protein, and the aqueous solution from the oil emulsion for food.

It has already been pointed out from the data in Tables 1 to 7 (the data in Tables 8 and 9 are not complete and cannot be used for this calculation) that the average water content of the fresh coconut meat is 51.8 per cent, the average oil content is 31.6 per cent, and the average nonoil solids content is 16.6 per cent. If we assume the protein contents of the fresh meat and of the *sapal* (coconut cake) found in Table 1, namely 3.5 per cent and 0.74 per cent, respectively, as the average protein contents in these two products, the amount of protein extracted after the third pressing would be around 2.8 per cent (based on the fresh coconut meat). If we further take as the average efficiency of extraction of nonoil solids after the third pressing, the value of 48 per cent, equivalent to 8 per cent (based on the fresh coconut meat) of protein and carbohydrates, the amount of sugars and other carbohydrates extracted would then be 5.2 per cent (based on the fresh coconut meat). This relationship is shown in Table 14.

TABLE 13.—*Cost of processing refined coconut oil from 30,000,000 nuts by the expeller process, disregarding by-products.*

[Assumed loss from molding, 5 per cent; plant capacity, 30,000,000 nuts per year]

Obtainable oil.			Available crude oil with 97 per cent efficiency of expeller.	Cost of extracting crude oil at 0.015 peso average per kilogram.	Cost of copraing at 0.50 peso per 1,000 nuts.	Cost of refining crude oil from 30,000,000 nuts at 0.018 peso per kilogram of oil.	Total cost of processing refined oil.	Total refined oil at 2 per cent loss of fatty acids, etc.	Cost of processing 1 kilogram refined coconut oil.	Cost of processing[a] 1 kilogram of refined oil at 0.018 peso for manufacture of crude oil and 0.018 peso for refining (average).	Loss of oil due to molding at 0.15 peso per kilogram.
Per 1000 nuts.		Total.									
Kg.	*Per cent.*	*Tons.*	*Tons.*	*Pesos.*	*Pesos.*	*Pesos.*	*Pesos.*	*Tons.*	*Pesos.*	*Pesos.*	*Pesos.*
108	30.5	3,080	2,980	48,600.00	15,000.00	53,640.00	117,240.00	2,920	0,0402	----------	25,500.00
116	32.6	3,300	3,200	48,600.00	15,000.00	57,600.00	121,200.00	3,140	0,0386	0,033	25,500.00
124	35.0	3,540	3,440	48,600.00	15,000.00	61,920.00	125,520.00	3,370	0,0373	----------	25,500.00

[a] Excluding copraing and losses in refining.

TABLE 14.—*Approximate composition of the by-products in the Lava process.*

[All percentages based on fresh coconut meat.]

Component.	Fresh meat.	Sapal.	Extracted substances.
Water	51.8		
Oil	31.6		
Nonoil solids	16.6	8.6	8.0
Protein	(3.5)	(0.74)	[a](2.8)
Sugar and other carbohydrates			[b](5.2)

[a] From centrifuge. [b] In aqueous solution.

The protein extracted is partly in the form of solids, which are obtained after the emulsion is centrifuged with the low-power centrifuge to obtain the cream, and after the treated cream is again centrifuged to obtain the oil, but most of this extracted protein is dissolved in the skimmed milk obtained during the first centrifuging. The sugars are found mostly in this aqueous extract.

Since we are at present working in a more detailed manner on the composition of coconut meat and on the distribution of its constituents among the different products and by-products, a discussion of the exact quantities of the by-products obtained would be premature and unnecessary. For the purposes of this article, however, it should therefore be sufficient to point out that from 1,000 nuts weighing 800 kilograms (husked) and containing 355 kilograms fresh meat, we can expect around 30 to 37 kilograms of dry, oil-free coconut cake, 2.4 to 10 kilograms of dry, oil-free protein cake, and around 18.5 kilograms of proteins, sugars, and other carbohydrates. Assuming a 92 per cent efficiency of oil recovery from nuts yielding 116 kilograms per 1,000, the amount of oil unextracted would be 9.3 kilograms, which for approximate purposes may be divided between the coconut cake and protein cake to yield approximately 37 to 44 kilograms of dry, oily coconut cake, and 4.7 to 12.3 kilograms of dry, oily protein cake.

Table 15 shows an approximate comparison of a possible income from by-products with the new process (excluding coconut shells not used for power), and the income from copra cake and meal by-products in the expeller process. The coconut cake is assumed to be transformed into flour and sold at 0.02 peso per kilo; the protein is assumed to be sold direct at 0.10 peso per kilo, instead of being converted into milk substitute or "Cocohoney." The sugars from the first maceration water are as-

sumed to be converted into vinegar with around 2.5 per cent acetic acid, which is sold at 0.03 peso per liter, a very, low estimate, considering the price of nipa vinegar.

While the comparison in Table 15 cannot be expected to be rigorous, it shows that an extra income of from 0.04 to 0.048 peso per kilogram of oil produced, may be obtained by the direct extraction of oil by the new process, over the expeller process. For a plant capacity of about 10 tons of oil a day, this extra income amounts to from 607 to 697 pesos a day (over that from oil alone).

TABLE 15.—*Comparison of approximate additional income from by-products of the Lava process and the expeller process.*

Item.	Lava process.	Expeller process.
By-products per 1,000 nuts [a]—pesos	[a] 6.07–6.97	[b] 1.95
Total income from by-products per year from 30,000,000 nuts—pesos	182,000.00–209,000.00	58,500.00
Total income from by-products per day (300 days a year)—pesos	607.00–697.00	
Average total production of oil per year [c]—tons	3,200	
Additional income per kilogram of oil, resulting from by-products—pesos	0.057–0.065	0.017

[a] Coconut cake, 37 to 44 kilograms, at 0.02 peso per kilogram, 0.74 to 0.88 peso.
Protein cake, 4.7 to 2.3 kilograms, at 0.10 peso per kilogram, 0.47 to 1.23 pesos.
Sugars with proteins, 18.5 kilograms (162 liters of 2.5 per cent acetic acid at 0.03 peso per liter), 4.86 pesos.

[b] Copra meal, 65 kilograms at 0.03 peso per kilogram.

[c] 92 per cent efficiency of recovery.

Since the coconut cake may be made to yield an income higher than that indicated in Table 15, since the protein cake together with the aqueous solution of coconut sugars can be converted into a more valuable product, and since the excess coconut shells not used for power requirements can be converted into metallurgical carbon or absorbent carbon, the prospect of this new process of oil extraction can be even brighter than indicated in this article.

SUMMARY AND RECOMMENDATIONS

1. From the standpoint of the coconut industry the expeller process for coconut oil extraction, which uses copra that has passed through various stages of decomposition for its raw material, is not economical, in spite of its high degree of mech-

anization and efficiency. One way of increasing the income of the industry is by improving the quality of copra.[7]

2. If the degree of extraction of oil emulsion from fresh coconut meat could be made high, and if the separation of the oil from the emulsion could be made efficient, oil extraction directly from fresh meat should be the more economical method, since a greater quantity of a superior quality oil is produced; the by-products could be used for food and thus be made to yield a greater income, and the shell by-product could be used not only for the power requirements of the plant but also for many other purposes.

3. Preliminary experiments on a laboratory scale and on a pilot-plant scale show that, in conjunction with the Lava process for coconut-oil extraction directly from fresh meat, the roller method of obtaining the oil emulsion from the coconut meat is better than the cage hydraulic press method, that an average of 86 per cent oil recovery can be made with the crude rollers used, but that improvements in the system of feeding fresh meat and in roller design are necessary before the process can be considered commercially practicable.

4. Calculations of the costs of processing of oil by this new process and by the expeller process, disregarding by-products, show that an oil recovery efficiency of from 76 to 81 per cent, or, at the most, of 92 per cent, with the new process, would be sufficient to compete with the expeller process.

5. A comparison of a possible income from by-products from the new process and the income from copra meal and cake from the expeller process shows that an extra income over that from the use of the latter process of from 0.04 to 0.048 peso per kilo of oil produced, may be obtained with the use of the former process.

6. Further improvements in the design of the roller press and in the feeding system for the comminuted meat, together with more intensive experiments on the utilization of the by-products of coconut oil obtained directly from fresh meat, are recommended.

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[7] One possible method is by taking the fresh meat from the shells, comminuting and drying it, as is done in the coconut desiccating plants, and finally passing the dried comminuted meat through expellers. In this way the cake can be sold at a much higher price than that of copra cake.

ILLUSTRATION

TEXT FIGURE

FIG. 1. Comparison of the cost of processing coconut oil by the Lava process with that of the expeller process, not taking into consideration by-products. I, Lava process for nuts giving 108 kilograms total obtainable oil per 1,000; II, Lava process for nuts giving 116 kilograms total obtainable oil per 1,000; III, Lava process for nuts giving 104 kilograms total obtainable oil per 1,000; A, expeller process including manufacture of copra; B, expeller process not including manufacture of copra.

PARAGONIMUS WESTERMANII

CASE REPORT WITH MICROPHOTOGRAPH OF OPERCULUM OF THE OVUM SPRUNG OPEN [1]

By C. M. HASSELMANN [2]

Practising Physician and Surgeon, Manila

TWO PLATES

The eggs of the following species of the more common parasitic helminths are operculated: *Paragonimus westermani, Clonorchis sinensis, Opisthorchis felineus, Metagonimus yokogawai,* and other heterophyids; and *Echinostoma ilocanum, Fasciola hepatica, Fasciolopsis buski,* and *Diphyllobotrium latum.* As I have never found in the available literature a photomicrograph of the operculum sprung open, I regard it as extremely good fortune that I am able to present here a photomicrograph obtained by me of this phenomenon.

The problem of paragonimiasis in the Philippines was first dealt with by Musgrave in 1907,[3] by Garrison [4] in 1908, and by Garrison and Leynes [5] in 1909. Recently interest in trematode infestation has increased in the Philippine Archipelago, due the opening up of new farm settlements, increased activity in the mining industry, and the resulting migration of populations and the discovery of new foci of infestation, especially in the northeastern coastal region of Mindanao.

The parasite in question was found in a male patient, 22 years old, a resident of Naga, Camarines Sur Province, Luzon. This man complained of cough and slight hæmoptysis in 1938, and again in 1940. Fever, general malaise, and other gross disease

[1] Demonstrated at the Scientific Meeting of the Manila Medical Society, held September 10, 1940.

[2] Staff member, St. Luke's Hospital; Assistant Professor, Afable College of Medicine and Surgery; former Special Consultant, U. S. Public Health Service, Washington, D. C.

[3] Musgrace, W. E. Paragonimiasis in the Philippine Islands. Philip. Journ. Sci. § B 2 (1907) 15–65.

[4] Garrison, P. E. Philip. Journ. Sci. § B 3 (1908) 203, 204.

[5] Garrison, P. E. and R. Leynes. Ibid. § B 4 (1909) 177–183.

symptoms were absent. His weight remained stationary at 54 kilograms, his sublingual temperature in the afternoon was 37.2° C., with pulse 76 of normal quality and rhythm. The urine was acid and negative for albumen, sugar urobilinogen, cellular elements, and casts. The number of red and white blood cells and the amount of hæmoglobin were all normal. Differential count revealed only a slight eosinophilia; nonsegmented polymorphonuclears, 3 per cent; segmented polymorphonuclears, 49 per cent; large lymphocytes, 2 per cent; small lymphocytes, 38 per cent; monocytes, 1 per cent; basophiles, 1 per cent, and eosinophiles, 6 per cent. Physical examination disclosed no gross pathological findings, except very moderate dullness on percussion over both entire lungs, together with decreased breathing sounds but without rales.

No acid-fast bacilli could be found in the blood-tinged, mucoid sputum, but the abundance of pus cells was suspicious. Examination of the fresh, native sputum preparation revealed the presence of the typical *Paragonimus* eggs.

In addition, an X-ray picture was made, and interpreted by Dr. R. C. Yuzon as follows:

> Presence of numerous, small, round, and scattered opaquities in a network of fibrosis in both hemithoraces, especially on the right side. A line of interlobitis in the right hemithorax. Pleura negative. Radiological impression: The character of the above mentioned opaquities not typical of tuberculous lesions of the lung; more indicative of numerous, small sacs of pus in scattered foci as encountered in staphylococcal pyemia.

Therapeutically, Emetine 0.05 was given intravenously several times, after which the slightly blood-stained sputum greatly diminished in quantity, and its color became whitish-yellowish. After that "Antimosan" was given intramuscularly. The patient soon felt well, and stayed away. It is, of course, impossible to evaluate the effect of the medication, since too few injections were given and no follow-up was possible, except to state that hæmoptysis promptly stopped after the second intravenous Emetine injection.

ILLUSTRATIONS

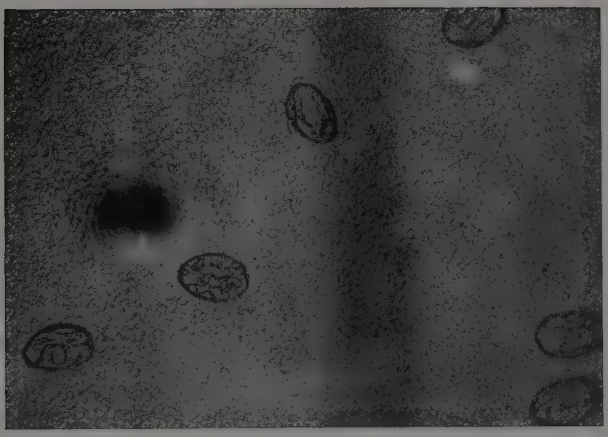
Plate 1

Fig. 1. Photomicrograph of ova *Paragonimus westermanii* in sputum; low power.

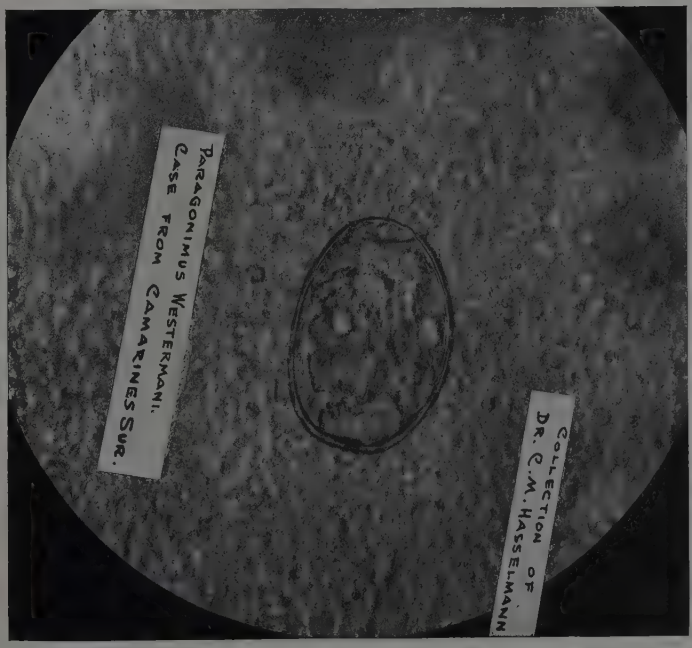
2. Photomicrograph of ovum of *Paragonimus westermanii* with operculum clearly visible; high power.

Plate 2

Photomicrograph of operculum of an ovum of *Paragonimus westermanii* sprung open.



1


PARAGONIMUS WESTERMANI.
CASE FROM CAMARINES SUR.
COLLECTION OF
DR. C. M. HASSELMANN

2

PLATE 1.

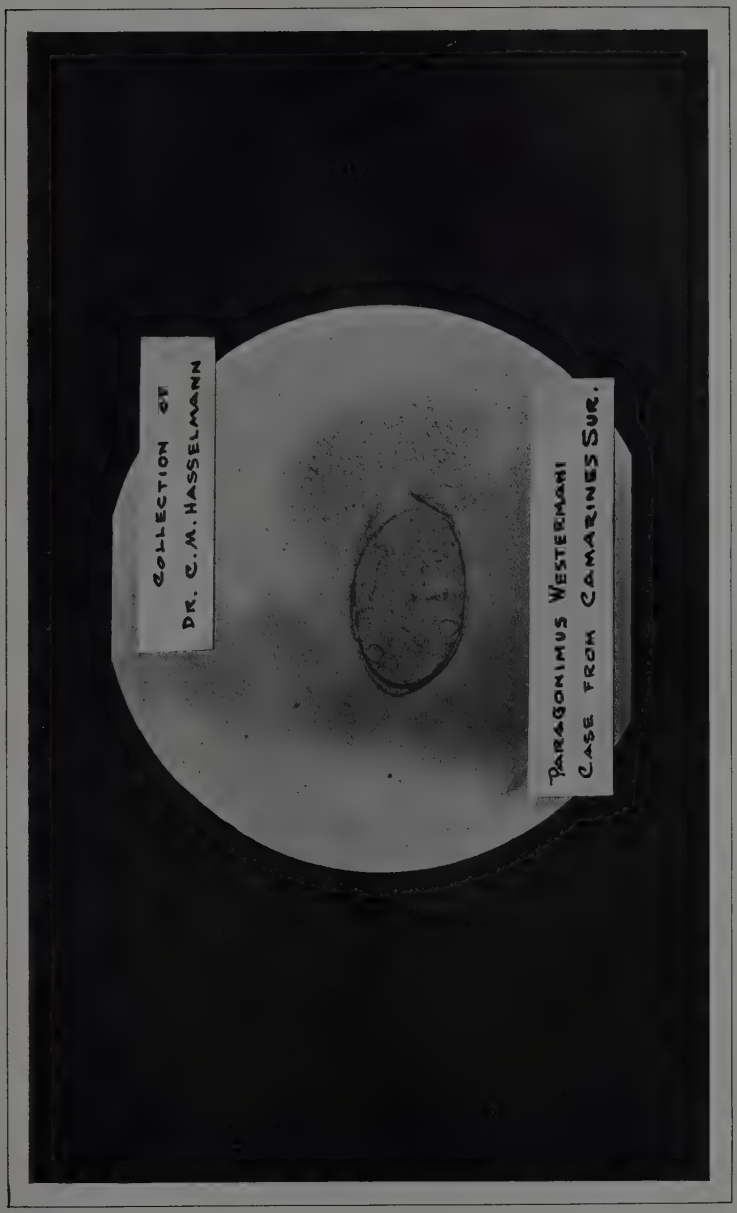

COLLECTION OF
DR. C. M. HASSELMANN
PARAGONIMUS WESTERMANI
CASE FROM CAMARINES SUR.

PLATE 2.

BOOKS

Books reviewed here have been selected from books received by the Philippine Journal of Science from time to time and acknowledged in this section.

REVIEWS

Fair and Warmer: The Problem of Weather Forecasting and the Work of the United States Weather Bureau. By Joseph Gaer. National Problem Series. New York, Harcourt, Brace and Company. 1939. 137 pp. Price, $1.

According to the author, "A description of weather and weather knowledge, the problems in weather forecasting, and an explanation of the work of the United States Weather Bureau—how it gathers its facts, when and where observations are made, and, most important of all, whom it serves—are the main concern of this book." Rather an ambitious program for such a small book! The book is written in journalistic style with emphasis on the bizarre. The description of the process of weather is not developed in any logical sequence nor does it give an intelligible picture of what goes on in the atmosphere. A disproportionate amount of space is devoted to a description of ancient ideas regarding weather signs and rain making. There are a number of loose statements, some historically false and others scientifically inaccurate. The book has one redeeming quality: it gives a comprehensive picture of the material benefits which the United States Weather Bureau confers on the taxpayers. The loss of property alone, leaving out the question of loss of life, which is prevented by the storm forecasts of the United States Weather Bureau, repays that country many times for what it has invested in meteorological services.—L. W. W.

Leaves and Stems from Fossil Forests. A Handbook of the Palæobotanical Collections in the Illinois State Museum. By Raymond E. Janssen. Popular Science Series, Vol. I. Springfield, Illinois, Illinois State Museum, 1939. 190 pp., illus. Price, $1.25.

This handbook of the palæobotanical collections in the Illinois State Museum is neatly printed and profusely illustrated. The treatment is decidedly simple, and easy for students to grasp because almost every species is clearly described and illustrated.

The author gives a short account of the formation of fossil remains and the exploration of valuable specimens, besides giving in outline form the group, family, and genus to which each species belongs. A brief history of palæobotany, a short bibliography, and an index to the species are also included.

As a whole, this handbook is undoubtedly useful to those interested in palæobotany. The careful reader will perhaps notice the misplacement of the Cordaitales between the Lycopodiales and the Equisetales.—E. T. K.

The Book of Birds. The First Work Presenting in Full Color All the Major Species of the United States and Canada. Edited by Gilbert Grosvenor and Alexander Wetmore. Washington, D. C., National Geographic Society, 1939. 2 vols., illus. Price, $5.

This set of two volumes in thirty-seven chapters depicts in literature and in illustrations most of the North American species of birds. All the articles included in this set have appeared over a period of years in the National Geographic Magazine. The haunts and habits of the birds are masterly described in a familiar style by famous American ornithologists, among them Dr. Alexander Wetmore, Dr. T. Gilbert Pearson, Dr. Robert Cushman Murphy, Dr. Arthur A. Allen, and Dr. Francis H. Herrick, supplemented by portraits largely in colors by the no less known Canadian artist-naturalist, Major Allan Brooks. The set will be a valuable addition to any nature library. It is by far the best literature for amateur bird students, and an important reference for professional ornithologists and artists as well.—C. G. M.

Strange Fish and Their Stories. By A. Hyatt Verrill. Boston, L. C. Page and Company, 1939. 220 pp., front., illus. Price, $2.50.

Written in a popular style for the consumption of the layman this book is readable and understandable. It contains interesting and entertaining descriptions of queer denizens of the seas, lakes, and streams throughout the world, together with vivid narrations of their unique and singular habits and behavior. In short, this work is rich in what we may term mysteries, oddities, and realities of the fishery world.

The first chapter deals with the relationship existing between man and fish, with emphasis laid on the part played by the ancient fishermen in important discoveries and explorations of unknown lands and uncharted seas. In the succeeding chapters the author describes the many and varied unique inhabitants of the watery world, some of which are worth mentioning.

It will perhaps be a surprise to many that there are some fishes that act as fishermen of their own kind; fishes that build nests like birds; fishes that climb trees, staying out of their natural habitat for some time without danger of death; fishes that fly; fishes that fight; fishes that shoot, not with steel guns or bullets, of course, but with water pistols; and fishes that possess terrible teeth capable of slashing and eating all animals, including man, that happen within their reach.

It will further interest the reader to learn that although some fishes are fierce warriors, others belong to the sentimental and emotional type known as kissing fishes. One perhaps wonders whether these continuously swimming fishes do not become tired. It is a fact that fishes sleep, and some, like parrot fishes, even don their "pajamas" in the act of changing their coloration before sleeping.

The work is abundant in fish oddities which will be enjoyed by all those who read it.—A. F. U.

Die Malaria-Uebertraeger. Eine Zusammenstellung der wichtigsten Anopheles-Arten mit Angaben ueber Verbreitung, Brutgewohnheiten, Lebensweise und praktische Bedeutung. By Fritz Weyer. Leipzig, Georg Tieme, 1939. 141 pp., illus. Price, Rm. 9.80.

The purpose of this excellently written and well-illustrated booklet is to familiarize the student and practitioner with the ecology, distribution, and practical importance of *Anopheles* in general and its species and subspecies in particular in the respective malarious countries. The author deliberately avoids the highly controversial subject of morphology and systematic nomenclature, leaving these still very much discussed topics outside of his present paper, except for an enumeration in index form of the various species and their known synonyms. In all sections the relation of mosquito to man in the transmission of malaria is the governing trend. Discussion of the many problems is unbiased, and quite up-to-date; for example, the old hypothesis that about 12 gametocytes are necessary per cc of blood for infecting the mosquito is branded as false, most likely 5 being sufficient, at least for *A. elutus*. The same modern attitude is adopted relative to the unproven hypothesis of pronounced androphylia of *Anopheles* with a low number of maxillar teeth.

In the first chapter the author discusses the complicated and protean problem of distribution and abundance of mosquitoes, their breeding habits, their susceptibility and infectiveness,

respectively, to the plasmodium and to man, the mosquito's life and custom relative to its preference to house, stable, and other hiding places, the importance of androphilia and zoophilia, and the life span and fertility of anopheles. In the second chapter an enumeration of the different malarious countries in the world is given with the respective *Anopheles* species encountered, and the third and concluding chapter discusses in detail these respective species relative to their habitat and importance.

Here the author falls somewhat short, but the subject is so immense that hardly any living scientist will remain free from reproof in attempting this discussion, since mastery of the complex aspect of Anophelinæ relative to geography and importance as a malaria vector is utterly impossible. Thus, to mention only two, although minor points: *Anopheles lindesayi* is not infrequently found in the mountains of the Philippines where the reviewer caught them in the late afternoon even at an altitude of about 2,000 meters near Mount Data in northern Luzon; *A. elutus* Edwards (also often referred to as *A. sacharovi* with apparently better priority claims) has been ignored by the author in its most important and dominating influence relative to its increasing dominance as one goes down the Adriatic coast in Dalmatia (Jugoslavia) from North to South, and the author has fallen into error in claiming this *A. elutus* to be a carrier today in the important province of Yunnan, in southwestern China.

It is hoped that the student and practitioner who is able to read German will often turn to this very ably written account where he is sure to find expert advice and help on many of his interrogations.—C. M. H.

Essentials of Medical Electricity. By Elkin P. Cumberbatch. London, Henry Kimpton. 1939. 528 pp., illus. Price, 12s/–.

This book covers the important field of physical therapy as practiced in medicine. It also incorporates a practical and theoretical consideration of the use of short-wave current and the ductothermic method. The discussion of many topics relative to fundamental principles and the practical applications of different physical energies in the treatment and diagnosis of diseases makes this work very useful to all. The book will no doubt prove a useful companion of the medical practitioner, and no physician interested in medical electricity can afford to remain without it.—P. S. C.

Victory Over Cancer Without Radium or Surgery. A Book Dealing With Cancer Causation, Cancer Prevention, and Cancer Cures for Laymen and Doctors. By Cyril Scott. London, Methuen and Co., Ltd. 272 pp. Price, 8s/6d.

In this book the author expresses himself at the outset as skeptical of the reception cancerologists and researchers will give to the facts stated; although, in citing malignant cases cured by nonsurgical and radiological methods, he does not support his claims with scientific data in the form of biopsy reports, pictures before, during, and after treatment, and follow-up control.

In the chapter, "Dangerous methods of prevention and treatment," the author reveals his opposition to, and prejudice against, the use of surgery and radiotherapy which the scientific world has accepted as the only treatment, up to the present, capable of curing certain types of cancer in a given percentage of cases. It is true that a real researcher must never refuse to see what he does not want to see, yet in the treatment of cancer one has to be rather conservative because in trying other methods, time, which is important in the success of surgery and radium therapy, may be lost with serious results.

The book, as written and presented by the author, is for the cancer specialist to read rather than for the layman, who is not in a position to discriminate between truth and halftruth in medicine.—P. S. C.

A Manual for Diabetic Patients. By W. D. Sansum, A. E. Koehler and R. Bowden. New York. The Macmillan Company, 1939. 227 pp., front., illus. Price, $3.25.

The authors of this book have outlined the meaning of diabetes mellitus, its cause, symptoms, and treatment. Their object is to instruct the diabetic patient the recognition of his disease, the proper care of his body, careful selection of his diet, avoidance of the onset of diabetic coma, the correct use of insulin, and the proper behavior in case of insulin reaction. By these instructions they do not intend to drive away the physician from a diabetic patient; rather, the intention is to help the patient to appreciate and to avail himself of the physician's instructions.—M. B.

Population, Race and Eugenics. By Morris Siegel. Hamilton, Ontario, The Author, 1939. 206 pp. Price, $3.

This book is the result of intensive studies of the different agencies that influence the mental and social qualities of the in-

dividual, the family, and the race. It offers some clinical and statistical data concerning social and occupational status in relation to rate of production and marriage among peoples. It includes a survey of the factors responsible for greater fertility in rural districts than in cities. It also treats of the cultural and intellectual correlation between parents and children and of facts about the differences between mental capacities in different individuals, and takes up the different etiologic factors as well as constructive recommendations to make the future generations mentally and physically strong.

The foundation and principles of all race theories by several authors are clearly discussed by the author. Among the important subjects taken up are the factors responsible for the differentiation of man into races; the physical, mental and social status of persons belonging to each race; and the racial theories in relation to racial achievements.

The last part of this book treats of the nature, prevalence, causes, and mode of transmission of the different forms of mental disorders. The author presents a brief survey of the existence of these maladies in different localities and introduces restrictive measures against them. The book is of immense value to the student of eugenics as well as to the person actively engaged in social work.—P. J. A.

A Policy for British Agriculture by the Rt. Honble. Lord Addison of Stallingborough, Minister of Agriculture 1930–1931. London, Victor Gollancz, Ltd. 1939. 304 pp. Price, 7s/6d.

This book, modestly dedicated by the author "To the memory of those on the farm I knew so well as a boy, and who inspired my love for the land," consists of twenty interesting chapters replete with valuable information for students and practictioners not only in agricultural science but also in economics and business. It is a story that vividly portrays the rise and fall of agriculture in Great Britain.

It opens with a discussion of agriculture as an industry, pointing out that "Mother Earth" is the basis of all. The author then skillfully weaves the relationship of high and low wages, advocating good farm wages and a higher standard of living for producers, and extolling the importance of agriculture in rural life and in national existence in time of war and in time of peace.

Chapter II is a kaleidoscopic view of the landlord, farmer, and laborer. How each of these bears an important rôle in the community, and how all three form the partnership that promotes the economic system, are described in clear, apt language.

Here the author describes the peculiar condition of farmers in relation to each other, saying that isolation and individualism are its outstanding characteristics. The preservation of the landscape and the opportunities for farmers and their reactions to marketing problems are emphasized. The farm laborer, with his well-known industry and endurance, and the rôle he plays in the economic life of the farming communities, is meticulously discussed.

Chapter V deals with land. The value and importance of land, its fertility, drainage, water supply, and improvements that make for the comfort of its occupants are all discussed, followed by a discussion in Chapter VI of farm produce and how it is sold, touching on the relation of good crops and producers' poverty and on local and national food surpluses, of both vegetable and fruit crops and animal and fish products.

In an introductory review the author discussed in the next chapter the needs of the good land system premised on the principle that the productive powers of land should be raised to its maximum according to a proper knowledge of what the land is best suited for, so that the whole agricultural population should be able to find contentment and prosperity while at the same time landscapes are preserved for enjoyment and fresh air.

Chapter VIII deals with land policy as affecting land acquisition, land values, taxation, and reforms of land laws with special reference to food supply and control. The succeeding chapters deal with finance, management, and development, embodying the financial duties of the National Commission—such as credit and related topics. Next, soil surveys, the promotion of farming enterprise, and the restoration of neglected lands are discussed. Chapter X explains the essentials of price management with reference to tariffs, quotas, and quantitative regulations, subsidies, and distribution.

There are chapters dealing with the formation of producers boards to remedy marketing difficulties due to individualistic tendencies of farmers; the control of imports as relating to the security of an abundant food supply for the people; the abolition of uncertainties of prices for home producers, and to effect economies in storage and distribution under an import board. The National Commission and Home Producers Boards function to secure fair prices for local producers and stabilization of fair price levels; then the problems of importation, distribution and wages are discussed at length under another chapter.

The author goes on to discuss a program of development dealing with outstanding food needs, under both peace and war-time conditions. Emphasis is laid on production and consumption.

The author concludes by emphasizing the need for a ministry of agriculture and food supplies and its relation to a National Agricultural Commission, and the need for the restoration of a progressive countryside to counteract the abandonment of farms. Discussion of land reclamation and afforestation have also been indulged in.

The reviewer believes that this book should serve as an encouragement for general progressive agricultural ideas in relation to the general economic development of any country.

—F. D. M.

Poultry Sanitation and Disease Control. The Complete Guide to Sanitation and Treatment of Disease. By B. F. Kaupp and R. C. Surface. Chicago, Kaupp and Surface, 1939. 420 pp., illus. Price, $3.50.

As the title indicates, this book is not a discussion of the poultry industry in general but merely a discussion of one particular phase—the sanitation and disease control of poultry. It is prepared not so much as a textbook as to give a dispassionate discussion of the fundamental factors underlying the control of such diseases as are threatening this industry.

This book is intended not only for poultry students and technical men, but for everybody interested in poultry raising. For this reason the authors have brought together scientific data and presented them in an orderly, clear-cut, and practical way. The vivid explanations and examples given are well supplemented by lavish illustrations. A glossary of scientific terms is included.

The poultry industry is one of the most important industries of every nation. The study of the sanitation and the control of the diseases of poultry, which has cost the United States around $100,000,000 annually, deserves the careful attention given to it in this book.—V. S. R.

—F. D. M.

Drilling and Production Practice, 1938. Sponsored by the Central Committee on Drilling and Production Practice, Division of Production, American Petroleum Institute. New York, American Petroleum Institute, 1939. 458 pp., illus. Price, $3.

This volume contains papers on drilling and production practice delivered at national or district meetings of the Division of Production during 1938. It is divided into four sections, covering Drilling practice, Production practice, Materials, and Miscellaneous topics. In addition, there is a bibliography of all papers presented at district meetings in 1938.

The group of papers included in the section of "Drilling practice" describes problems of close spacing in Kansas, use of drilling muds, and well-depth measurements. There are several worthwhile papers on drilling practice on the Gulf Coast, the Permian Basin, the Oriskany sand fields of Kanawha County, West Virginia, and Dominguez field, California. The application of electrical logging methods to West Texas problems is also given.

There are several papers on production practice that cover a wide range of oil field problems,—pressure maintenance, bottomhole pressures, relationship of production to pressure, and gas-oil ratio. Another group of papers under the same heading covers many oil-well pumping problems, giving costs and efficiencies of various systems in different fields. Three papers of this group discuss problems from producing sands. They are: Well shooting, experiments on fluid capacity of oil-well screens, and the theoretical consideration of the perforation pattern in a screen pipe.

The section on the Materials is rather brief. Three papers deal with the physical properties of casing steel, welding properties of casings, and specifications for oil-well cement.

The Miscellaneous papers include a discussion of the production problems in consideration of the lighter crudes. There is one paper on subsurface oil sampling.

A bibliography of district meeting papers for 1938 concludes the volume.—G. W. C.

Metallurgical Analysis and Assaying. By J. Stewart Remington and F. L. Jameson. London, The Technical Press, Ltd., 1939. 101 pp. Price, 5s/–.

This book is a compilation of selected standard methods of analysis of elements commonly determined in most ore laboratories and assay offices. Grouped according to the accepted qualitative scheme of analysis, the elements are taken up in six chapters. The seventh chapter is devoted to special procedures, while the eighth contains useful chemical and mathematical data. In general the methods are presented with the least amount of detail and theoretical discussion. Hence this book is of practical value only to those who have had sufficient experience in analytical work.—B. R. S.

Minerals, Metals and Gems. By A. Hyatt Verrill. Boston, L. C. Page and Co., 1939. 293 pp., front., illus. Price, $3.

This book is a miniature encyclopedia of minerals and gems, interestingly and accurately written for the general public. The pages are filled with strange stories and anecdotes about minerals from different lands and from all ages. The author has succeeded in giving a general course in mineralogy and ore deposits in a manner that the average reader can appreciate and absorb easily. The first part of the book is devoted to the more common minerals—how and where they are mined. "Ordinary" and precious stones are then taken up. The last chapters give a very instructive and entertaining treatment of crystallography and economic mineralogy. There is a glossary of minerals and mineral terms at the end of the book.—J. B. B.

Delectable Dinners: Menus with Recipes. By Anna J. Peterson and Nena Wilson Bodenoch. New York, E. P. Dutton, Inc., 1939. 460 pp. Price, $2.50.

This book is prepared to help the general homemaker and average cook solve the daily problems of planning, buying, preparing, and serving dinners in a short time and in a very practical manner. Unlike other cook books, which generally deal with individual recipes only, this book plans recipes into menus appropriate for a good dinner, dinner being the principal meal in the average American household. The basis of all food combinations in this book is the main protein dish, as meat, poultry, fish, or their substitutes. The menus are planned for four courses which can be simplified according to individual choice.

This book is divided into ten chapters with various kinds of meat. There are 30 menus with beef, 12 with veal, 12 with lamb, 6 with mutton, 7 with pork, 8 with ham, 14 with meat sundries, 15 with meat substitutes, 15 with poultry, and 29 with fish. Each chapter begins with a chart of menus planned around different cuts of the same kind of meat, so that at a glance one can tell the food and flavor combination for a certain meal. Each menu is then treated separately with all the necessary recipes for the whole meal. Each chapter includes top-stove and oven dinners; last minute or preparation-in-advance dinners; hot weather dinners; dinners for special occasions; dinners for guests; dinners for the family.

In addition to these menus and recipes, this cook book includes time tables for every menu, for baking, and for boiling vegetables, general directions for success in cooking, general rules for successful marketing, instructions for carving, a cook's dictionary, chapters on serving, table setting, healthful eating and nutrition, a list of useful staple substitutes, appropriate menus for special occasions, an alphabetical index, and a classified group index.

The arrangement of this book is practical and helpful for the modern homemaker. But where the individual recipes or even the menus themselves are concerned, the materials called for in the recipes are too costly for the average Filipino homemaker.—P. A. E.

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